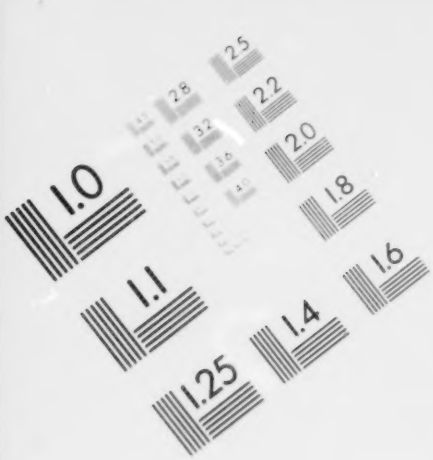

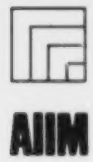

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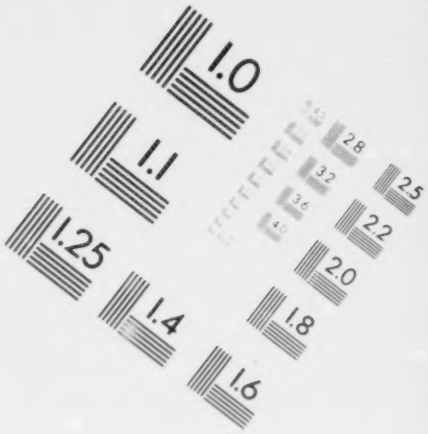

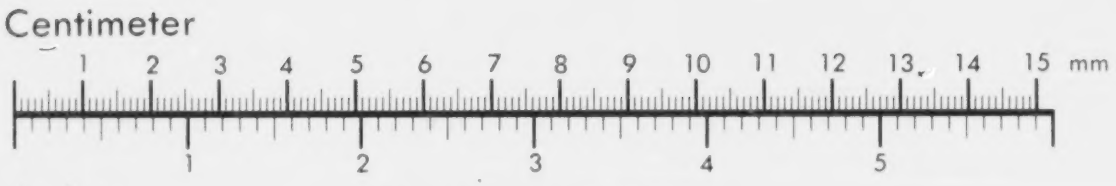

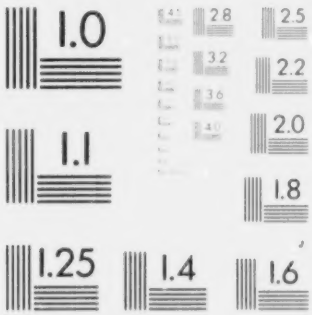

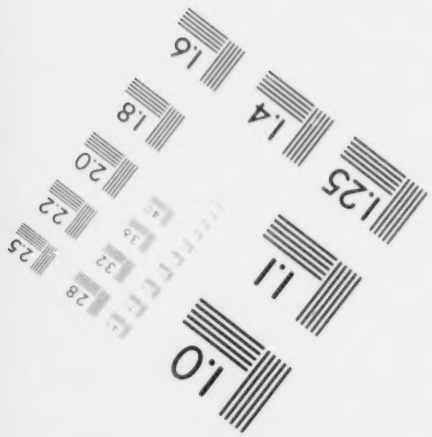

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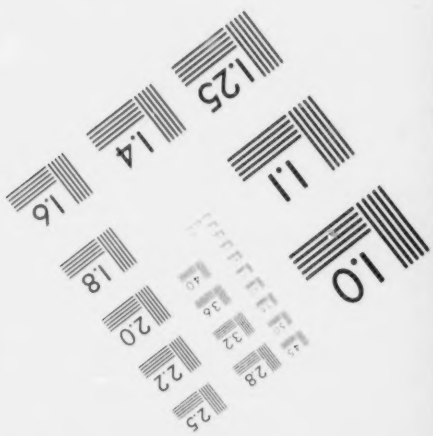

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ABSTRACT.

The National Center for Education Statistics (NCES) administered a short survey of public school teachers in 1999 that included items on teachers' use of computers and the Internet. This report draws on that survey to describe teachers' use of education technology in their classrooms and schools, availability of this technology, their training and preparation for their use, and barriers to technology use they encounter. Additional data sources are used throughout the report to provide background information on these topics. Findings indicate that about half of the teachers with computers available in their schools used them for classroom instruction. Teachers' use of technology was related to their training and preparation and work environments. Teachers were more likely to use these technologies when the technologies were available to them, available in their classrooms as opposed to computer labs, and available in great numbers. Teachers who reported feeling better prepared were more likely to use these technologies than their less prepared colleagues. (Teachers who spent more time in professional development reported feeling better prepared than their colleagues.) Teachers who perceived that lacking computers and time for students to use computers as great barriers were less likely than their colleagues to assign students to use computers or the Internet for some instructional activities. Appendices include standard error tables for text tables and figures, survey methodology and data reliability, and the survey questionnaire. (AEF)

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Teachers' Tools for the 21st Century: A Report on Teachers' Use of Technology

By. Becky Smerdon, Stephanie Cronen, Lawrence Lanahan, &
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Executive Summary

Background

As the availability of computers and the Internet in schools and classrooms has grown (e.g., Williams, 2000), so has interest in the extent to which these technologies are being used and for what purposes. Using the Fast Response Survey System (FRSS), NCES administered a short survey of public school teachers in 1999 that included items on teachers' use of computers and the Internet. This report draws on that survey to describe teachers' use of education technology in their classrooms and schools, the availability of this technology in their classrooms and schools, their training and preparation for their use, and the barriers to technology use they encounter. Additional data sources (e.g., National Assessment of Educational Progress [NAEP], Current Population Survey [CPS]) are used throughout the report to provide background information on these topics.

Key Findings

Technology and Instruction

Over the past ten years, NCES has administered surveys focusing primarily on technology (e.g., computers, connections to the Internet) infrastructure in schools and classrooms. The 1999 FRSS survey focused on availability of technology and the way in which these technologies are used. According to this survey:

- Approximately half of the public school teachers who had computers or the Internet available in their schools used them for classroom instruction (table 2.3). Teachers assigned students to use these technologies for word processing or creating spreadsheets most frequently (61 percent did this to some extent), followed by Internet research (51 percent), practicing drills (50 percent), and solving problems and analyzing data (50 percent—figure 2.6). Moreover, many teachers used computers or the Internet to conduct a number of preparatory and administrative tasks (e.g., creating instructional materials, gathering information for planning lessons) and communicative (e.g., communication with colleagues) tasks.

- Among those with technology available in their schools, teachers in low minority and low poverty schools were generally more likely than teachers in high minority and high poverty schools to use computers or the Internet for a wide range of activities, including gathering information at school, creating instructional materials at school, communicating with colleagues at school, and instructing students. For example, 57 percent of teachers in schools with less than 6 percent minority enrollments used computers or the Internet for Internet research compared with 41 percent of teachers in schools with 50 percent or more minority enrollments (table 2.4).

- Among teachers with computers available at home, teachers with the fewest years of experience were more likely than teachers with the most years of experience to use computers or the Internet at home to gather information for planning lessons (76 percent compared with 63 percent) and creating instructional materials (91 percent compared with 82 percent—table 2.1). They were also generally more likely than more experienced teachers to use these technologies to access model lesson plans at school and at home.

Availability and Use of Technology

On a most basic level, teachers may be more likely to integrate computers and the Internet into classroom instruction if they have access to adequate equipment and connections. The 1999 FRSS survey on teachers' use of technology provides teachers' perspectives on the availability of computers and the Internet in their schools and classrooms and the general frequency with which these technologies are used. Results of this survey indicate that:

- Nearly all public school teachers (99 percent) reported having computers available somewhere in their schools in 1999 (table A-3.9); 84 percent had computers available in their classrooms, and 95 percent had computers available elsewhere in the school (table 3.1). Teachers were generally more likely to use computers and the Internet when located in their classrooms than elsewhere in the school (figure 4.3), while their students were more likely to use computers and the Internet outside the classroom than inside (figure 4.8). Additionally, teachers and students with computers or Internet connections *in their classrooms* used these technologies *elsewhere in the school* more often than teachers and students without such tools in their classrooms (figures 4.5 & 4.10).

- Most public school teachers (84 percent) reported having at least one computer in their classrooms in 1999 (table 3.1). Thirty-six percent of teachers had one computer in their classrooms, 38 percent reported having two to five computers in their classrooms, and 10 percent reported having more than five computers in their classrooms (table 3.2). Teachers and students with more computers or computers connected to the Internet in their classrooms generally used these technologies more often than teachers with fewer computers or Internet connections.

- In 1999, computer and Internet availability was not equally distributed among schools. For example, teachers in schools with the lower minority enrollments (less than 6 percent or 6 to 20 percent) were more likely to have the Internet available in the classroom than

teachers in schools with the highest minority enrollments (50 percent or more minority enrollments—69 percent and 71 percent compared with 51 percent—table 3.3). Moreover, teachers in schools with the lowest minority enrollments (less than 6 percent) were more likely to report having two to five computers connected to the Internet than teachers in schools with the highest minority enrollments (19 percent compared with 9 percent—table 3.4).

- Eighty-two percent of public school teachers reported having a computer available at home, 63 percent of public school teachers had the Internet available at home, and 27 percent reported that their school had a network that they could use to access the Internet from home (table 3.6).

Teacher Preparation and Training

Teachers' preparation and training to use education technology is a key factor to consider when examining their use of computers and the Internet for instructional purposes. The 1999 FRSS survey indicates that:

- In 1999, approximately one-third of teachers reported feeling well prepared or very well prepared to use computers and the Internet for classroom instruction (table A-5.5), with less experienced teachers indicating they felt better prepared to use technology than their more experienced colleagues (figure 5.1). For many instructional activities, teachers who reported feeling better prepared to use technology were generally more likely to use it than teachers who indicated that they felt unprepared (table 5.1).

- Teachers cited independent learning most frequently as preparing them for technology use (93 percent), followed by professional development activities (88 percent) and their colleagues (87 percent—figure 5.2). Whereas half of all teachers reported that college and graduate work prepared them to use technology, less experienced teachers were generally much more likely than their more experienced colleagues to indicate that this education prepared them to use computers and the Internet (figures 5.2 and 5.3).

- Most teachers indicated that professional development activities on a number of topics were available to them, including training on software applications, the use of the Internet, and the use of computers and basic computer training (ranging from 96 percent to 87 percent—figure 5.4). Among teachers reporting these activities available, participation was relatively high (ranging from 83 to 75 percent—figure 5.6), with more experienced teachers generally more likely to participate than less experienced teachers (table 5.3). Teachers indicated that follow-up and advanced training and use of other advanced telecommunications were available less frequently (67 percent and 54 percent, respectively), and approximately half of the teachers reporting that these two activities were available to them participated in them.

- Over a 3-year time period, most teachers (77 percent) participated in professional development activities in the use of computers or the Internet that lasted the equivalent of 4 days

or less (i.e., 32 or fewer hours—figure 5.7). Teachers who spent more time in professional development activities were generally more likely than teachers who spent less time in such activities to indicate they felt well prepared or very well prepared to use computers and the Internet for instruction (table 5.4).

Barriers to Teachers' Use of Technology

Certain characteristics of classrooms and schools, such as equipment, time, technical assistance, and leadership, may act as either barriers to or facilitators of technology use. The 1999 FRSS survey indicates that:

- In 1999, the barriers to the use of computers and the Internet for instruction most frequently reported by public school teachers were not enough computers (78 percent), lack of release time for teachers to learn how to use computers or the Internet (82 percent), and lack of time in schedule for students to use computers in class (80 percent—figure 6.1). Among the barriers most frequently reported by teachers to be "great" barriers to their use of computers or the Internet for instruction in 1999 were not enough computers (38 percent) and lack of release time for teachers to learn how to use computers or the Internet (37 percent).

- Teachers' perceptions of barriers to technology use varied by a number of teacher and school characteristics. For example, secondary teachers, teachers in large schools, and teachers in city schools were more likely than elementary teachers, teachers in small schools, and teachers in rural schools, respectively, to report that not enough computers was a great barrier (table 6.1). Additionally, teachers in schools with more than 50 percent minority enrollments were more likely to cite outdated, incompatible, or unreliable computers as a great barrier than teachers in schools with less than 6 percent minority enrollments (32 percent compared with 22 percent).

- Generally, teachers' who perceived lacking computers and time for students to use computers as great barriers were less likely than those who did not perceive these conditions as barriers to assign students to use computers or the Internet for some instructional activities. For example, teachers who reported insufficient numbers of computers as a great barrier were less likely than teachers reporting that this was not a barrier to assign students to use computers or the Internet to a "large extent" for practicing drills (9 percent compared with 19 percent), word processing or creating spreadsheets (14 percent compared with 25 percent), and solving problems and analyzing data (6 percent compared with 13 percent—table 6.2).

Summary

The primary focus of this report is teachers' use of computers or the Internet for instructional purposes. Findings presented in this report indicate that about half of the teachers with computers available in their schools used them for classroom instruction. Moreover, teachers' use

of technology was related to their training and preparation and work environments. As described in detail in the report, teachers were more likely to use these technologies when the technologies were available to them, available in their classrooms as opposed to computer labs, and available in greater numbers. Moreover, teachers who reported feeling better prepared were more likely to use these technologies than their less prepared colleagues. (Teachers who spent more time in professional development reported feeling better prepared than their colleagues.) Finally, teachers who perceived that lacking computers and time for students to use computers as great barriers were less likely than their colleagues to assign students to use computers or the Internet for some instructional activities.

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CHAPTER 1

Introduction

Over the past two decades, modern technologies have transformed many aspects of American life, including how we communicate, how we spend our free time, and especially how we work. As American life and workplace demands have changed as a result of this "technological revolution," so have conceptions of the skills and knowledge children will need to become successful adults and the relevant educational experiences they should encounter while attending school. As a result, technology, specifically in the form of computers and the Internet, has become a major focus of education policy and reform in recent years. National, state, and local initiatives have provided schools with computer hardware and software, allowed schools and classrooms to connect to the Internet, and supported technology-focused professional opportunities for teachers (Coley, 1997; U.S. Department of Education, 1996).

To date, most research on this topic has focused on the availability of education technology (i.e., computer hardware, software, and equipment and Internet connections) in schools and classrooms. Over the past decade, the National Center for Education Statistics (NCES) of the U.S. Department of Education has collected such data and shown that availability has grown dramatically. For example, Internet access in public schools increased by 60 percentage points between 1994 and 1999, from 3 percent in 1994 to 63 percent in 1999 (Williams, 2000). By 1999, 95 percent of public schools were connected to the Internet, with one instructional computer with an Internet connection for every 9 students (Williams, 2000).

As the numbers of computers and access to the Internet in schools have grown, so have the number of questions being asked about the extent to which these technologies are being used in schools and classrooms and for what purposes. Using the Fast Response Survey System (FRSS), NCES administered a short survey of public school teachers in 1999 that included items on teachers' use of computers and the Internet. This report draws on that survey, along with additional data sources (e.g.,

National Assessment of Educational Progress [NAEP], Current Population Survey [CPS])[1], to describe teachers' use of education technology in their classrooms and schools, their training and preparation for that use, and the school and classroom contexts within which they do or do not use these technologies. This report also includes an examination of the relationships between teachers' use of technology and these contextual factors. As a preface to discussing these empirical results, the introductory chapter highlights literature on technology and instruction.

Technology and Instruction

The U.S. Department of Education, in its *Getting America's students ready for the 21st Century: Meeting the technology literacy challenge,* described computers as "the new basic" of American education, and the Internet as "the blackboard of the future" (U.S. Department of Education, 1996, p. 3). Over the past 20 years, education technology has been a major focus of reform and policy at the federal level, as well as at state and local levels. Such initiatives have been guided by the goals of increasing the availability of computers in classrooms and schools, assisting schools with Internet access, and providing resources and guidance for teacher training and the integration of technology into the curriculum. The availability of computers and the Internet has increased significantly in the nation's schools and classrooms (Williams, 2000). This increase has been coupled with initiatives aimed toward understanding how best to use technology to improve teaching and learning and training educators to use technology effectively.

Existing research on education technology includes a small number of national studies that describe teachers' use of technology, as well as their training to use these tools. Specifically, this research suggests that most current and past uses of education technology have typically supported traditional notions of teaching and learning. For example, in the early 1980s, students most often used computers for drill and practice (Becker, 1983). Typically, drill-and-practice software consists of sequences of worksheet-style questions that automatically adjust their difficulty to match individual students' responses. Also, in the early 1980s, teachers typically used computers to teach students programming skills (Becker, 1983). They rarely used computers for content-related instruction (Becker, 1985); students were more likely to learn about how to use computers at school than they were to use computers to learn about mathematics or social studies (Becker, 1983).

By the early 1990s, the practice of using computers for programming had declined considerably and an emphasis on using computers as a tool for learning content had emerged (Becker, 1994; Sutton, 1991). However, the primary use of computers remained drill and practice in elementary schools in the early 1990s. In high schools, it was classes on computer education, and middle schools provided a combination of drill and practice and computer education (Becker, 1994). Finally, as the decade of the 1990s progressed, school computer use had shifted to some degree to reflect a greater emphasis on problem solving and in-depth learning and less emphasis on drill and practice and basic skills. Fulton (1997) found that 25 percent of the 1996

[1] All data presented in this report are for public school students, with the exception of CPS data.

high school graduates who participated in the Scholastic Assessment Test (SAT) program reported having used computers for solving math problems, processing data, or computer programming. Approximately 10 percent had used computers to solve problems in natural science. Using a nationally representative sample of teachers, the Teaching, Learning, and Computing Study found that CD-ROM reference and surfing the Internet were more likely to be assigned as classroom activities than games and traditional drill-and-practice applications (Becker, 1999). However, many of these newer uses have been limited to a small proportion of teachers and students.

Teachers are in fact using computers or the Internet generally more frequently to complete a number of instruction-related tasks than to augment instruction itself (Becker, 1999). For example, they may use these technologies to help prepare for classroom instruction (e.g., to access research on best practices, download information to present in class) or to complete administrative tasks (e.g., to record and calculate grades). The Teaching, Learning, and Computing Study also indicated that two-thirds of all teachers used the Internet in their effort to find information for use in their lessons, and about one-third reported doing so on at least a weekly basis (Becker, 1999). In addition, teachers may also use technology to communicate with parents or students about students' performance, assignments, or special events. They may also use technology to communicate with other members of their profession to share ideas or strategies for presenting content or helping students who are struggling with the content. Sixteen percent of teachers in the Teaching, Learning, and Computing Study communicated by e-mail with teachers from other schools as often as five times during the school year, and 18 percent of teachers said they posted information on the Internet, including suggestions, opinions, or student work (Becker, 1999).

Teacher Training and Preparation

As the brief history of technology use for learning suggests, the way educators teach and students learn has not changed dramatically over the past two decades. The research on teacher change and instructional reform in general indicates that such changes in teacher practice are often slow, minimal, or even nonexistent (Ball, 1990; Cohen, 1990; Peterson, 1990). A number of factors contribute to the success or failure of instructional reforms. One important factor the literature has identified is that teachers do not always have opportunities to learn about and practice instructional reforms. In the area of technology, teachers may have learned about how to use computers and adapt their teaching from a variety of sources—teacher preparation programs (for prospective teachers), professional development activities (for practicing teachers), and informal learning opportunities such as assistance from classmates, colleagues, or students.

Professional development research suggests that teachers' opportunities to learn about education technology during traditional professional development activities are often lacking. Often described as an important vehicle for school reform (Sprinthall, Reiman, & Theis-Sprinthall,

1996), professional development activities in general have been widely criticized for being relatively ineffective. Specifically, they have been described as short term, devoid of continuity due to inadequate follow-up and the lack of ongoing feedback from experts, isolated from the participants' classroom and school contexts, and characterized by too few opportunities to learn by doing and reflecting with colleagues (Fullan with Stiegelbauer, 1991). In fact, while a majority of teachers participate in such activities, a small percentage of teachers report feeling very well prepared to integrate technology into instruction (Lewis et al., 1999).

Teacher preparation programs have received similar criticisms. Traditional programs for prospective teachers have been described as fragmented, superficial, and unconnected to real classroom experiences (National Commission on Teaching and America's Future [NCTAF], 1996). With respect to education technology, some observers have claimed that prospective teachers are not getting the training they need to successfully integrate technology into classroom instruction (President's Committee of Advisors on Science and Technology, 1997). For example, some researchers have reported that most students training to become teachers do not routinely use technology while in the field and do not work under supervising teachers who can advise them on using technology in the classroom (Moursund & Bielefeldt, 1999). Additionally, about half of the technology training that prospective teachers get in the classroom is delivered as part of other classes (i.e., methods and curriculum classes), and the other half is provided in the form of stand-alone technology classes (Moursund & Bielefeldt, 1999). Furthermore, most teacher-preparation programs provided by schools, colleges, and departments of education do not have written, funded, regularly updated technology plans (Moursund & Bielefeldt, 1999).

Informal learning opportunities, in addition to these formal learning opportunities, may also provide teachers with assistance using technology. Peer collaboration, in particular, has been heralded by many teachers, researchers, and policymakers as essential for teachers' continuous learning (Coley, 1997). Teachers may benefit when they learn about technology from one another and provide one another with motivation to continue working with this resource. Research supports this proposition; teachers who use computers benefit from interacting with a network of other teachers at their school who also use computers (Software and Information Industry Association [SIIA], 2000).

Technology Use in Schools and Classrooms

In recent years, policymakers have recognized that teachers and administrators need resources and organizational capacity to implement instructional reforms (CEO Forum on Education and Technology, 2000; Coley, 1997; Means, 1995; SIIA, 2000; Trotter, 1999; U.S. Department of Education, 1996; U.S. Congress, Office of Technology Assessment, 1995a). For example, teachers' ability and willingness to use computers and the Internet may depend, to some extent, on the schools and classrooms in which they work. Specifically, certain characteristics of classrooms and schools, such as equipment, time, technical assistance, and leadership, may act as either barriers to or facilitators of technology use.

Equipment

On a most basic level, teachers may be more likely to integrate computers and the Internet into classroom instruction if they have access to adequate equipment and connections. Research indicates that the number of computers in America's classrooms and schools has grown substantially in recent years. In 1983, there was one computer for every 125 students (Glennan & Melmed, 1996). By 1998, there was one computer for every 6 students (Rowand, 1999). As the number of computers in schools has grown, so has the availability of the Internet in schools and classrooms. Between 1994 and 1998, Internet availability among public schools increased from 35 to 95 percent (Williams, 2000). In 1997, 27 percent of instructional rooms had Internet connections, whereas 63 percent were connected in 1999 (Williams, 2000). By 1999, there was one instructional computer with an Internet connection for every 9 students (Williams, 2000).

However, availability is not the same as use. Computers may be available, but are they being used? Research suggests that the answer is yes, to some degree. As availability has grown, so has the number of students and teachers using computers and the frequency with which they use them (Levin et al., 1998). For example, the percent of eleventh-grade students who had never used computers in school dropped substantially between 1984 and 1996 (from 55 to 16 percent) and the frequency with which students used computers increased between 1984 and 1996 (Snyder and Wirt, 1998). By 1996, 72 percent of fourth-graders, 47 percent of eighth-graders, and 50 percent of eleventh-graders reported using a computer in school at least once a week (Snyder and Wirt, 1998).

Although the presence of computers and the Internet has grown sharply in recent years, much of the technology equipment currently in schools and classrooms is from an earlier generation of technology—computers with less processing power, less storage capability, and limited capacity for being linked together electronically (Anderson & Ronnkvist, 1999). Using data from 1998, Anderson and Ronnkvist (1999) have concluded that although computing capacity for instruction has improved substantially over the past several years, there are a number of "major deficiencies" (p. 16). For example, they found that most of the computers in schools do not have the capability to run a large variety of multimedia software and are also limited in how they can access graphical information on the Internet.

Time

The nation's schools have been increasingly challenged by policy initiatives "to do better, and to do differently" (McLaughlin & Oberman, 1996, p. iv), pushing teachers to change the way they teach. At the same time, teachers face many other challenges, including rapidly increasing technological changes and a greater diversity in the classroom. With regard to technology, there is often little time in teachers' schedules to become familiar with hardware and software or to learn to integrate the new technology into their lesson plans (President's Committee of Advisors on Science and Technology, 1997). Lack of time to become acquainted with technology and learn to use it has been identified as the greatest obstacle to the effective use of education technology (Becker, 1990b; President's Committee of Advisors on Science and Technology, 1997).

Technical Assistance

Another important resource for the development of teacher expertise in the use of education technology is technical assistance. A full-time computer coordinator, for example, may assist teachers with using computer software and hardware or adapting their teaching practice to include computer or Internet use. However, according to one study, less than 5 percent of all schools have such a staff member. Furthermore, where they are present, computer coordinators typically spend a significant amount of time teaching students, and much less time assisting teachers (Becker, 1998).

Leadership

Principal leadership has been described as one of the most important factors affecting the effective use of technology in classrooms (Byrom, 1998). Principals who exhibit leadership are instrumental in modeling the use of technology in classrooms. They understand how it can support best practices in instruction and assessment and provide teachers with guidance for its use. Principals may also participate actively in professional development activities related to education technology and provide teachers with opportunities to learn how to use these resources. In our nation's schools, however, teachers often receive little administrative and pedagogical guidance (President's Committee of Advisors on Science and Technology, 1997). For some teachers, lack of principal leadership may prove to be a barrier to their effective use of technology.

General Framework

The previous discussion described three general topics of high importance in current studies of education technology. First, the growing interest in how technology is being used in schools and classrooms and the limited research on this topic illustrate the importance of examining whether and how teachers use education technology. Second, because teachers may be more likely to use education technology and to use it more effectively if they have opportunities to learn about its use, it is valuable to understand how prepared teachers feel to use technology and their learning experiences. Finally, it is important to understand the extent to which teachers' school and classroom environments (e.g., the availability of and access to technology, supports for and barriers to technology use) are related to their technology use. These general topics suggest that a useful model for studying education technology would begin with examining whether and how teachers use it and then explore the teacher preparation and training, and the school and classroom contexts, that characterize where technology is used and where it is not used.

Study Methodology

Three sources of data are presented in this report—the Fast Response Survey System [FRSS], the Current Population Survey [CPS], and the National Assessment of Educational Progress

(NAEP). These data sources share a number of differences that preclude comparisons among them. For example, the CPS findings that are presented include both public and private school teachers. The FRSS and NAEP findings presented in this report include only public school teachers. Additionally, for the NAEP, students were sampled and their teachers surveyed. Thus, unlike the FRSS teacher survey, the NAEP data are not nationally representative of teachers.

All comparative statements in this report have been tested for statistical significance using chi-square tests or *t*-tests adjusted for multiple comparisons using the Bonferroni adjustment and are significant at the 0.05 level. Appendix B provides a detailed discussion of the sample and survey methodology. The primary teacher characteristic used as an analysis variable in this report is total years of teaching experience (3 or fewer years, 4 to 9 years, 10 to 19 years, 20 or more years). In addition to work experience, this variable may also, though not necessarily, represent for many teachers their age or cohort (e.g., teachers with fewer years of experience may be young and newly-trained). The school characteristics used as analysis variables in this report are school instructional level, school enrollment size, locale (city, urban fringe, town, rural), percent minority enrollment, and percent of students in school eligible for free or reduced-price school lunch (which indicates the concentration of poverty in the school). These variables are defined in appendix B.

It is important to note that many of the school characteristics used for independent analyses may also be related to each other. For example, enrollment size and instructional level of schools are related, with secondary schools typically being larger than elementary schools. Similarly, poverty concentration and minority enrollment are related, with schools with a high minority enrollment also more likely to have a high concentration of poverty. Other relationships between analysis variables may exist. Because of the relatively small sample size used in the FRSS, it is difficult to separate the independent effects of these variables. Their existence, however, should be considered in the interpretation of the data presented in this report.

Organization of This Report

The remaining chapters of the report are organized around the following themes: (1) technology and instruction, (2) availability, (3) frequency of use, (4) teacher training and preparation, and (5) barriers to technology use. Each chapter presents results from the NCES Fast Response Survey System 1999 teacher survey of education technology. In addition, findings from other surveys will be referenced throughout this report to provide context for the FRSS data. Computer and Internet usage supplements to the CPS, a monthly survey of the U.S. population conducted by the Census Bureau, will provide a backdrop for American students' and teachers' computer and Internet usage. NCES's NAEP will assist in providing a more detailed portrait of implementation of technology in U.S. schools. Conclusions are provided in the final chapter of the report. Technical information, including a detailed study methodology (appendix B) and tables of standard errors for all data presented in this report (appendix A), are included as technical appendices to the report. The questionnaire is included in appendix C.

Chapter 2

Technology and Instruction

Highlights

- In 1999, among teachers with computer availability in their schools, many used computers or the Internet to conduct a number of preparatory and administrative tasks (e.g., creating instructional materials, gathering information for planning lessons) and communicative (e.g., communication with colleagues) tasks. However, teachers generally used these technologies less frequently for such tasks as accessing research, best practices examples, and model lesson plans, as well as communicating with parents and students.

- Approximately half of public school teachers who had computers available in their schools used computers or the Internet for classroom instruction. Teachers assigned students to use these technologies for word processing or creating spreadsheets most frequently, followed by Internet research, practicing drills, and solving problems and analyzing data.

- Elementary teachers were more likely than secondary teachers to use the computer or Internet to communicate with parents at home, use the computer or Internet for classroom instruction, assign projects inside the classroom, or assign students to use computers to practice drills or to solve problems and analyze data. On the other hand, secondary teachers were more likely than elementary teachers to use computers or the Internet for administrative record keeping at home and school, as well as communicating with students at school, assigning projects outside of class, and assigning students to conduct research using the Internet.

- Teachers in low minority and low poverty schools were generally more likely than teachers in high minority and high poverty schools, respectively, to use computers or the Internet for a wide range of activities, including gathering information at school, creating instructional materials at school, communicating with colleagues at school, and instructing students.

- Teachers with the fewest years of experience were more likely than teachers with the most years of experience to use computers or the Internet to gather information for planning lessons and creating instructional materials at home. They were also generally more likely than more experienced teachers to use these technologies to access research and best practices examples at school and model lesson plans at school and at home.

CHAPTER 2

Technology and Instruction

This report investigates teachers' use of technology for instructional purposes. This chapter begins with background information on teacher and student use of technology from the 1992 and 1998 administrations of the National Assessment of Educational Progress (NAEP). Following this are results of the 1999 Fast Response Survey System (FRSS) survey on teacher use of technology. Specifically, three types of technology use are discussed: (1) preparation and administration, (2) classroom instruction, and (3) communication. Included is information that relates technology use to school and teacher characteristics.

Technology Use in Schools and Classrooms: Findings from NAEP

NAEP asked both teachers and students about computer use over the past four administrations of the surveys. The data presented in this chapter come from surveys of of public school teachers of grades 4 and 8, and surveys of students in grade 12. The surveys were administered in 1992, 1996, and 1998. The NAEP findings presented in this chapter are based on all public school teachers and come from the 1992 and 1998 surveys.[1]

Computer Use for Reading and Writing Instruction

In 1998, teachers of grades 4 and 8 were asked the extent to which they assigned students to use computers for a number of instructional purposes, including: to practice spelling, punctuation, and grammar, to write drafts, to read stories, and to use software for reading instruction. Teachers of fourth- and eighth-grade students reported that their students used computers for writing drafts most frequently (teachers re-

[1] NAEP findings are provided for contextual purposes only. Due to differences in survey items and sample, NAEP findings are not comparable to FRSS findings.

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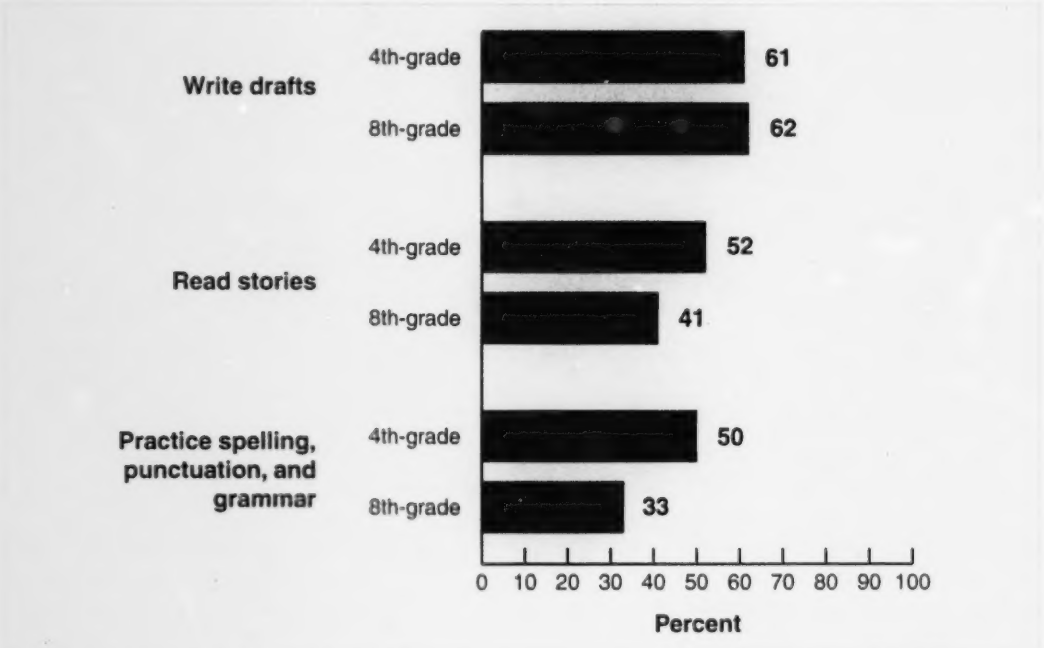
FIGURE 2.1.—PERCENT OF 4TH- AND 8TH- GRADE PUBLIC SCHOOL STUDENTS WHO HAVE TEACHERS REPORTING STUDENT USE OF COMPUTERS FOR VARIOUS CLASS ACTIVITIES: 1998



SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1998 Reading Assessments.

ported 61 percent of fourth-grade students and 62 percent of eighth-grade students did this to any extent—figure 2.1).[2] This was followed by reading stories and practicing spelling, punctuation, and grammar. Teachers' assignment of activities using the computer varied by instructional level. Teachers of fourth-graders were more likely than teachers of eighth-grade students to report that their students used computers to read stories and practice spelling, punctuation, and grammar.

Between 1992 and 1998, there was an increase in the proportion of teachers reporting that eighth-grade students used computers to write drafts (35 percent in 1992 compared with 63 percent in 1998) and practice spelling, punctuation, and grammar for writing instruction (15 percent in 1992 compared with 32 percent in 1998—figure 2.2).

Teachers of twelfth-grade students were not surveyed in recent NAEP administrations, though twelfth-grade students were surveyed and asked about their technology use for writing instruction. Seventy-seven percent of twelfth-graders indicated that they used computers to write drafts/final versions of papers, 45 percent used computers to practice spelling, punctuation, and grammar, and 27 percent used computers to write in a log or journal (table A-2.5).

[2] All comparative statements in this report have been tested for statistical significance using chi-square tests or *t*-tests adjusted for multiple comparisons using the Bonferroni adjustment and are significant at the 0.05 level.

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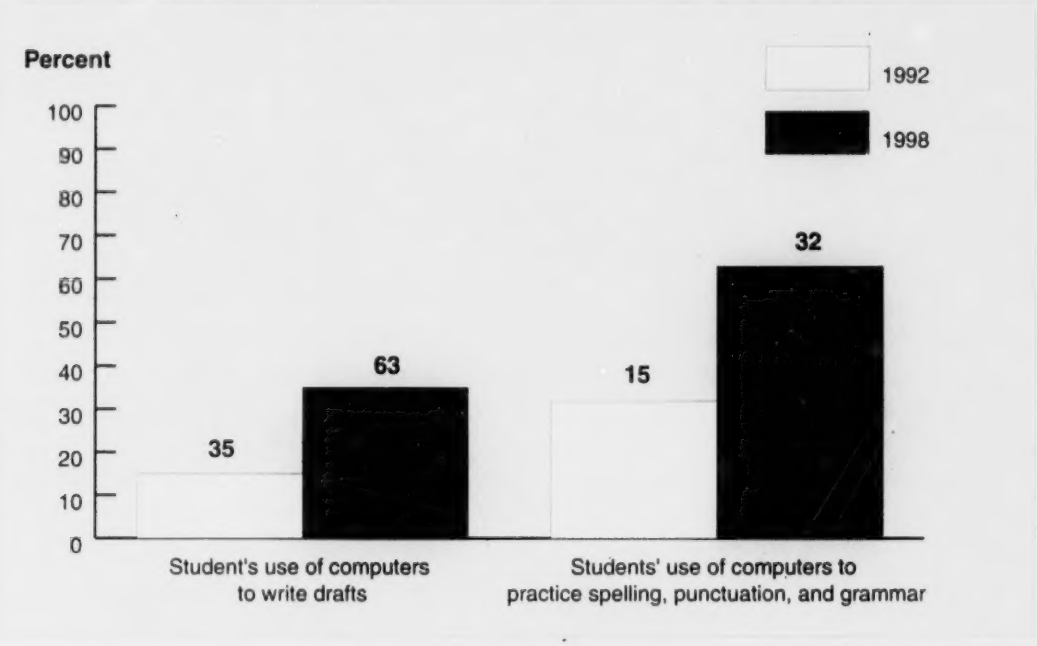
FIGURE 2.2.—PERCENT OF 8TH- GRADE PUBLIC SCHOOL STUDENTS WHO HAVE TEACHERS REPORTING STUDENT USE OF COMPUTERS TO WRITE DRAFTS AND PRACTICE SPELLING, PUNCTUATION, AND GRAMMAR: 1992 AND 1998



SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1992 and 1998 Writing Assessments.

Technology Use in Schools and Classrooms: Findings from FRSS[3]

Preparatory and Administrative Tasks

In 1999, the 99 percent of public school teachers who reported computer availability in school indicated that they used computers or the Internet at school to accomplish a number of preparatory and administrative tasks. Overall, 78 percent of public school teachers used computers or the Internet at school to create instructional materials, and 59 percent of teachers reported using computers or the Internet at school to gather information for planning lessons (figure 2.3).[3] Public school teachers also used computers or the Internet at school for administrative record keeping (51 percent), accessing research and best practices for teaching (37 percent), preparing multimedia presentations for class (36 percent), and accessing model lesson plans (34 percent).

In addition to using computers or the Internet at school for preparatory and administrative tasks, the 82 percent of teachers with computers available at home also used these technologies at home for such purposes.[4] For example, among these teachers with computers at home, public

[3] All of the FRSS findings presented in this chapter are based on teachers who reported having computers available in their schools (99 percent) or, for questions about technology use at home, teachers who reported having computers available at home (82 percent).

[4] The same teachers may be using computers for preparatory and administrative purposes both at home and at school.

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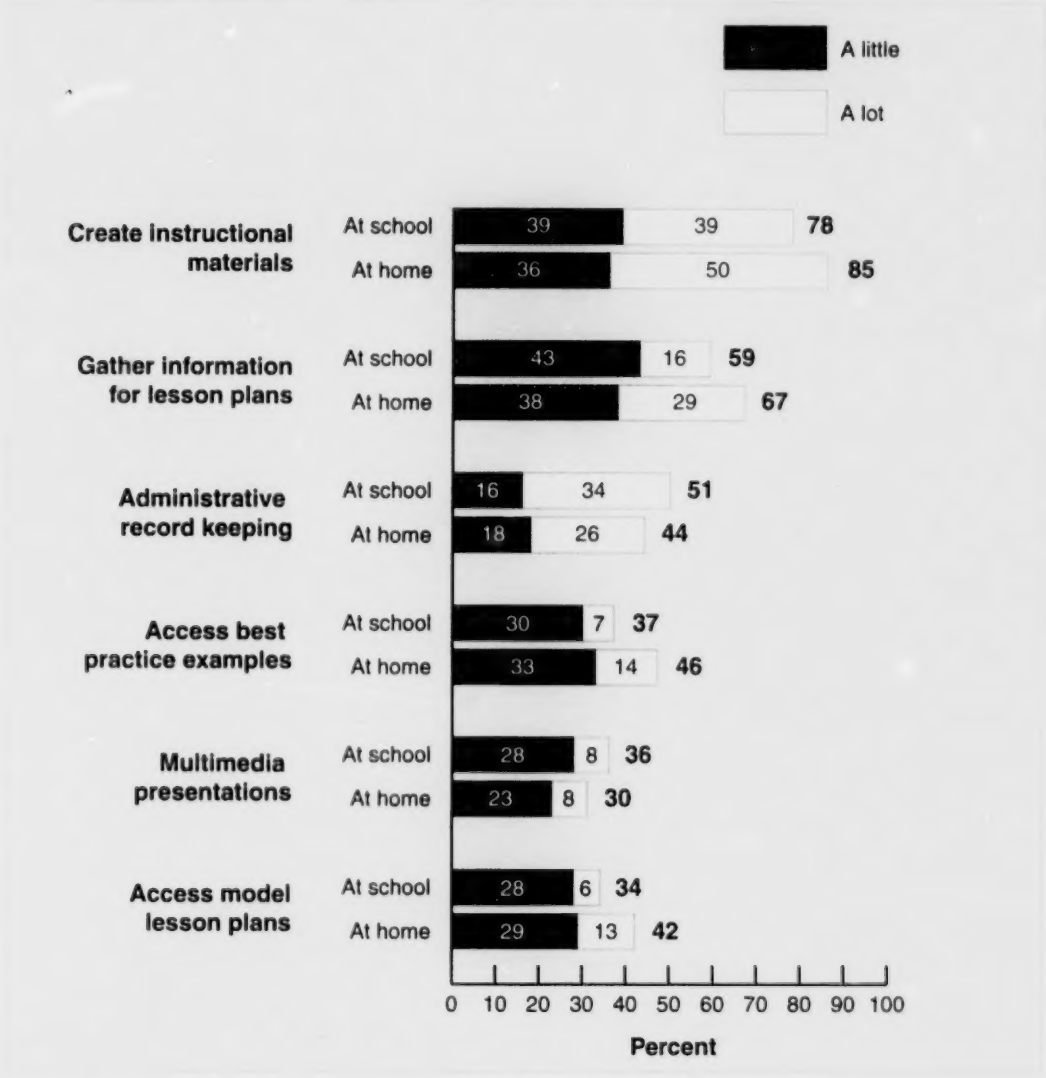
FIGURE 2.3.—PERCENT OF 4TH- AND 8TH-GRADE PUBLIC SCHOOL STUDENTS WHO HAVE TEACHERS USING COMPUTERS FOR VARIOUS CLASS ACTIVITIES: 1996



SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 Science Assessments.

school teachers used computers or the Internet at home to create instructional materials (85 percent), to gather information (67 percent), as well as for administrative record keeping (44 percent), accessing research and best practices for teaching (46 percent), preparing multimedia presentations for class (30 percent), and accessing model lesson plans (42 percent).

Differences by school and teacher characteristics. Teachers' use of technology for preparatory and administrative purposes varied by a number of school and teacher characteristics. For example, among teachers with computers available in their schools, secondary teachers were more likely than elementary teachers to use computers or the Internet at school for administrative record

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keeping (62 percent compared with 45 percent), and they were also more likely to do this at home than elementary teachers (50 percent compared with 41 percent—table 2.1). Moreover, teachers in schools with the fewest students enrolled were more likely than teachers in schools with the highest enrollments to use these technologies at school to gather information for planning lessons (67 percent compared with 56 percent). On the other hand, teachers in schools enrolling more students were generally more likely to use computers or the Internet at school for administrative record keeping (58 percent of teachers in schools with more than 1,000 students enrolled compared with 49 percent in schools with 300 to 999 students) and at home for this task (53 percent of teachers in schools enrolling 1,000 or more students compared with 35 percent of teachers in schools with less than 300 students and 42 percent in schools with 300 to 999 students).

In addition to instructional level and enrollment size, there were a number of differences by school minority enrollment in the percent of teachers reporting that they used computers or the Internet for preparatory and administrative tasks. For example, teachers in schools with lower minority enrollments were more likely than teachers in schools with the highest minority enrollments to gather information for lesson plans using these technologies at school (61 percent of teachers in schools with less than 6 percent, 67 percent of teachers in schools with 6 to 20 percent, and 60 percent of teachers in schools with 21 to 49 percent minority enrollments compared with 46 percent of teachers in schools with 50 percent or more minority enrollments).

Teachers in schools with fewer minority students were also generally more likely than those in schools with the highest minority enrollments to use computers or the Internet at school for administrative record keeping (55 percent of teachers in schools with 6 to 20 percent and 21 to 49 percent minority enrollments compared with 40 percent of teachers in schools with 50 or more minority enrollments) and creating instructional materials (81 percent of teachers in schools with 6 to 20 percent minority enrollments and 82 percent of teachers in schools with 21 to 49 percent minority enrollments compared with 71 percent of teachers in schools with 50 percent or more minority enrollments). Finally, teachers in schools with the lowest minority enrollments (less than 6 percent) were more likely than those with the highest minority enrollments (50 percent or more) to use computers or the Internet at school for preparing multimedia presentations (40 percent compared with 29 percent).

As is the case with teacher reports from schools with varying minority enrollments, teacher reports of whether they used computers or the Internet for various preparatory and administrative tasks varied by poverty concentration of the school, as measured by the proportion of students eligible for free or reduced-price lunch. For example, teachers in schools with the lowest poverty concentrations were more likely to use computers or the Internet at school to create instructional materials than teachers in schools with the highest poverty concentrations (85 percent compared with 73 percent). In addition, teachers in schools with lower poverty concentrations were generally more likely than teachers in schools with the highest poverty concentrations to use these technologies at school to gather information for planning lessons

TABLE 2.1.—PERCENT OF PUBLIC SCHOOL TEACHERS WHO HAVE COMPUTERS AT SCHOOL OR AT HOME REPORTING USING COMPUTERS OR THE INTERNET A LITTLE OR A LOT AT SCHOOL AND AT HOME FOR VARIOUS ACTIVITIES, BY SCHOOL AND TEACHER CHARACTERISTICS: 1999

	Activities					
	Create instructional material		Gather information for lesson plans		Administrative record keeping	
School and teacher characteristics	At school	At home	At school	At home	At school	At home
All public school teachers	**78**	**85**	**59**	**67**	**51**	**44**
Instructional level						
Elementary	79	86	57	66	45	41
Secondary	77	84	62	69	62	50
Enrollment size						
Less than 300	79	81	67	63	49	35
300 to 999	79	87	58	67	49	42
1,000 or more	75	84	56	69	58	53
Locale						
City	76	85	53	66	46	49
Urban fringe	79	87	60	70	49	41
Town	79	86	60	69	60	45
Rural	82	82	64	60	55	41
Percent minority enrollment in school						
Less than 6 percent	79	86	61	68	51	42
6 to 20 percent	81	86	67	68	55	46
21 to 49 percent	82	87	60	65	55	45
50 percent or more	71	83	46	67	40	44
Percent of students in school eligible for free or reduced-price school lunch						
Less than 11 percent	85	86	65	72	57	48
11 to 30 percent	80	87	63	68	54	45
31 to 49 percent	79	87	60	62	49	40
50 to 70 percent	77	84	55	64	51	46
71 percent or more	73	83	49	63	43	41
Teaching experience						
3 or fewer years	79	91	60	76	52	46
4 to 9 years	82	87	61	70	53	51
10 to 19 years	79	86	58	66	54	42
20 or more years	76	82	58	63	47	41

See note at end of table.

TABLE 2.1.—PERCENT OF PUBLIC SCHOOL TEACHERS WHO HAVE COMPUTERS AT SCHOOL OR AT HOME REPORTING USING COMPUTERS OR THE INTERNET A LITTLE OR A LOT AT SCHOOL AND AT HOME FOR VARIOUS ACTIVITIES, BY SCHOOL AND TEACHER CHARACTERISTICS: 1999—CONTINUED

School and teacher characteristics	Activities					
	Access research and best practice examples		Multimedia presentations		Access model lesson plans	
	At school	At home	At school	At home	At school	At home
All public school teachers	**37**	**46**	**36**	**30**	**34**	**42**
Instructional level						
Elementary	34	46	36	29	34	43
Secondary	42	49	35	33	35	40
Enrollment size						
Less than 300	44	47	38	29	38	40
300 to 999	36	46	36	28	34	43
1,000 or more	36	48	33	36	31	40
Locale						
City	35	47	36	31	36	43
Urban fringe	38	49	38	31	31	43
Town	38	46	32	31	35	42
Rural	39	41	35	25	36	39
Percent minority enrollment in school						
Less than 6 percent	39	50	40	32	35	43
6 to 20 percent	41	42	38	30	37	39
21 to 49 percent	33	45	35	32	31	40
50 percent or more	35	49	29	27	33	48
Percent of students in school eligible for free or reduced-price school lunch						
Less than 11 percent	44	49	41	33	30	40
11 to 30 percent	40	49	40	32	36	43
31 to 49 percent	33	41	32	27	38	38
50 to 70 percent	33	44	36	31	31	40
71 percent or more	35	43	32	26	35	47
Teaching experience						
3 or fewer years	39	55	34	31	42	59
4 to 9 years	43	52	39	32	40	47
10 to 19 years	37	42	37	33	30	38
20 or more years	33	43	34	26	31	37

NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the "At school" analyses presented in this table. Teachers who reported not having a computer available at home were excluded from the "At home" analyses presented in this table.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

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(65 percent of teachers in schools with less than 11 percent and 63 percent of teachers in schools with 11 to 30 percent of students eligible for free or reduced-price school lunch compared with 49 percent of teachers in schools with 71 percent or more students eligible for free or reduced-price school lunch).

Finally, teachers with varying years of teaching experience differed with respect to whether they used computers or the Internet to conduct a number of preparatory and administrative tasks. For example, teachers with the fewest years of teaching experience were more likely than teachers with the most experience to use these technologies at home to gather information for planning lessons (76 percent compared with 63 percent) and to create instructional materials (91 percent compared with 82 percent). Teachers with 4 to 9 years of experience were more likely to use computers or the Internet at school to access research and best practices examples than those with 20 or more years of experience (43 percent compared with 33 percent). Finally, teachers with less than 10 years of teaching experience were generally more likely to use these technologies at school to access model lesson plans than those with 10 to 19 years of experience (42 percent of teachers with 3 or fewer years and 40 percent of teachers with 4 to 9 years of teaching experience compared with 30 percent of teachers with 10 to 19 years of teaching experience) and at home to conduct this task (59 percent of teachers with 3 or fewer years and 47 percent of teachers with 4 to 9 years of experience compared with 37 percent of teachers with 20 or more years of teaching experience).

Communication

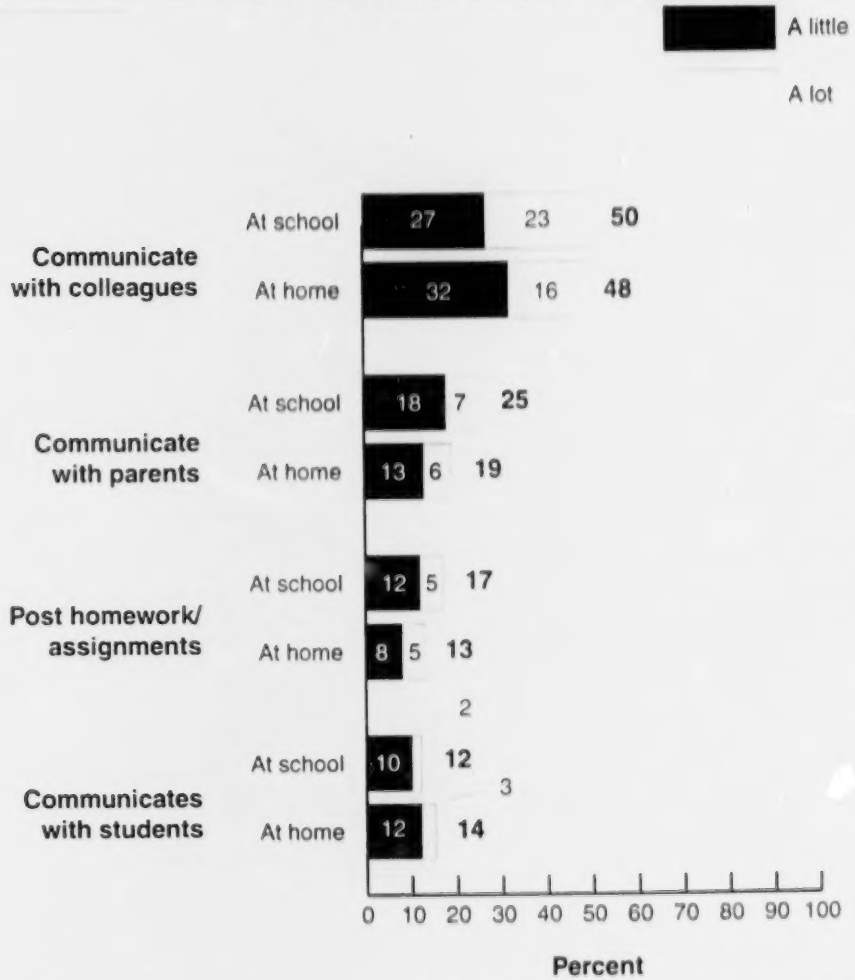
The 1999 FRSS survey on public school teachers' use of technology also asked teachers how often they used computers or the Internet either at school or at home to communicate with colleagues, parents, or students or to post homework or assignments. Public school teachers with computers available in their schools used computers or the Internet to communicate with colleagues most frequently (50 percent at school, 48 percent at home), compared to communication with parents (25 percent at school, 19 percent at home), posting homework or assignments (17 percent at school, 13 percent at home), and communication with students (12 percent at school and 14 percent at home—figure 2.4).

Differences by school and teacher characteristics. Teachers' use of technology for communicative purposes varied by a number of school and teacher characteristics. For example, elementary teachers were more likely than secondary teachers to use computers or the Internet at home to communicate with parents (20 percent compared with 15 percent, respectively—table 2.2). On the other hand, secondary teachers were more likely than elementary teachers to use these technologies at school to communicate with students (14 percent compared with 10 percent). Furthermore, teachers in schools with medium-sized enrollments were more likely than teachers in schools with small enrollments to report that they used computers or the Internet at home to communicate with colleagues (50 percent of teachers in schools with 300 to 999 students compared with 38 percent of teachers in schools with less than 300 students). Teachers in schools with large enrollments were also more likely to use these technologies at school to post homework or assignments (23 percent in schools with 1,000 or more students compared

with 16 percent in schools with 300 to 999 and 11 percent in schools with less than 300 students) and at home to conduct this task (19 percent of teachers in schools with 1,000 or more students compared with 11 percent in schools with 300 to 999 and 7 percent in schools with less than 300 students).

Teachers' use of computers or the Internet for communicative purposes also varied by minority enrollment of the school. Teachers in schools with lower minority enrollments were generally more likely than teachers in the highest minority schools to use these technologies at school to communicate with colleagues (53 percent of teachers in schools with less than 6 percent minority enrollments and 62 percent of teachers in schools with 6 to 20 percent minority enroll-

FIGURE 2.4.—PERCENT OF PUBLIC SCHOOL TEACHERS WHO HAVE COMPUTERS AT SCHOOL OR AT HOME REPORTING USING COMPUTERS OR THE INTERNET A LITTLE OR A LOT AT SCHOOL AND AT HOME, FOR VARIOUS TASKS: 1999



NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the "At school" analyses presented in this figure. Teachers who reported not having a computer available at home were excluded from the "At home" analyses presented in this figure. Detail may not sum to totals due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

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TABLE 2.2.—PERCENT OF PUBLIC SCHOOL TEACHERS WHO HAVE COMPUTERS AT SCHOOL OR AT HOME REPORTING USING COMPUTERS OR THE INTERNET A LITTLE OR A LOT AT SCHOOL AND AT HOME, FOR VARIOUS ACTIVITIES, BY SCHOOL AND TEACHER CHARACTERISTICS: 1999

School and teacher characteristics	Activities			
	Communicate with colleagues		Communicate with parents	
	At school	At home	At school	At home
All public school teachers	**50**	**48**	**25**	**19**
Instructional level				
Elementary	51	49	25	20
Secondary	50	48	24	15
Enrollment size				
Less than 300	52	38	23	21
300 to 999	52	50	25	19
1,000 or more	46	49	24	18
Locale				
City	48	48	23	19
Urban fringe	50	51	25	19
Town	54	50	27	17
Rural	53	43	24	20
Percent minority enrollment in school				
Less than 6 percent	53	50	28	20
6 to 20 percent	62	48	30	17
21 to 49 percent	46	51	25	21
50 percent or more	41	44	14	16
Percent of students in school eligible for free or reduced-price school lunch				
Less than 11 percent	59	52	28	16
11 to 30 percent	55	53	29	21
31 to 49 percent	54	45	29	18
50 to 70 percent	41	44	20	22
71 percent or more	38	40	18	15
Teaching experience				
3 or fewer years	51	51	22	20
4 to 9 years	52	46	25	18
10 to 19 years	52	50	25	18
20 or more years	48	48	25	19

See note at end of table.

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TABLE 2.2.—PERCENT OF PUBLIC SCHOOL TEACHERS WHO HAVE COMPUTERS AT SCHOOL OR AT HOME REPORTING USING COMPUTERS OR THE INTERNET A LITTLE OR A LOT AT SCHOOL AND AT HOME, FOR VARIOUS ACTIVITIES, BY SCHOOL AND TEACHER CHARACTERISTICS: 1999—CONTINUED

School and teacher characteristics	Activities			
	Post homework/ assignments		Communicate with students	
	At school	At home	At school	At home
All public school teachers	**17**	**13**	**12**	**14**
Instructional level				
Elementary	16	12	10	13
Secondary	20	13	14	17
Enrollment size				
Less than 300	11	7	8	12
300 to 999	16	11	12	14
1,000 or more	23	19	13	17
Locale				
City	18	14	11	13
Urban fringe	17	12	10	16
Town	17	13	15	14
Rural	17	11	13	13
Percent minority enrollment in school				
Less than 6 percent	16	11	12	15
6 to 20 percent	14	9	14	15
21 to 49 percent	20	11	11	15
50 percent or more	18	19	8	12
Percent of students in school eligible for free or reduced-price school lunch				
Less than 11 percent	14	11	10	12
11 to 30 percent	16	12	14	17
31 to 49 percent	21	13	14	14
50 to 70 percent	17	12	9	15
71 percent or more	19	16	9	10
Teaching experience				
3 or fewer years	19	16	12	13
4 to 9 years	18	12	12	17
10 to 19 years	18	11	11	15
20 or more years	16	13	11	13

NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the "At school" analyses presented in this table. Teachers who reported not having a computer available at home were excluded from the "At home" analyses presented in this table.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

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ments compared with 41 percent of teachers in schools with 50 percent or more minority enrollments). Similarly, teachers in schools with lower minority enrollments were also more likely to use computers or the Internet at school to communicate with parents than teachers in schools with the highest minority enrollments (25 percent to 30 percent of teachers in schools with less than 50 percent minority enrollments compared with 14 percent of teachers in schools with 50 percent or more minority enrollments). On the other hand, teachers in schools with high minority enrollments (50 percent or more) were more likely than teachers in schools with minority enrollments of 6 to 20 percent to use these technologies at home to post homework or assignments (19 percent compared with 9 percent, respectively).

Like minority enrollment, poverty concentration of the school is related to teachers' use of technology for communicative purposes. For example, teachers in schools with lower poverty concentrations were generally more likely than teachers in the highest poverty schools to use computers or the Internet to communicate with colleagues. Fifty-nine percent of teachers in schools with less than 11 percent, 55 percent of teacher in schools with 11 to 30 percent, and 54 percent of teachers in schools with 31 to 49 percent of students eligible for free or reduced-price school lunch used these technologies at school for this purpose, compared with 38 percent of teachers in schools with 71 percent or more students eligible for free or reduced-price school lunch. Similarly, 53 percent of teachers in schools with poverty concentrations of 11 to 30 percent eligible for free or reduced-price school lunch used these technologies at home to communicate with colleagues, compared with 40 percent of teachers in schools with 71 percent or more students eligible for free or reduced-price school lunch.

Classroom Instruction

In addition to preparation for instruction, administrative tasks, and communication, teachers may also use computers or the Internet for a number of instructional activities in their classrooms. The 1999 FRSS survey on public school teachers' use of technology asked teachers how often they used computers or the Internet during class time and assigned students to use these technologies for projects and various other activities, including: word processing/spreadsheets, Internet research, practice drills, solving problems/analyzing data, CD-ROM research, multimedia projects, graphical presentations, demonstration/simulation, and correspondence with experts.

General classroom instructional use. Fifty-three percent of public school teachers indicated that they used computers or the Internet for instruction during class time (table 2.3). Elementary teachers were more likely to do this than secondary teachers (56 percent compared with 44 percent), and teachers in schools with smaller enrollments were more likely to do this than teachers in schools with the largest enrollments (56 percent of teachers in schools enrolling less than 300 and 300 to 999 students compared with 40 percent of teachers in schools with 1,000 or more students). Teachers in schools with lower minority enrollments were generally more likely to use computers or the Internet for instruction during class time than teachers in schools with high minority enrollments (56 percent of teachers in schools with less than 6 percent minority enrollment compared with 45 percent of teachers in schools with 50 percent or more

TABLE 2.3.—PERCENT OF PUBLIC SCHOOL TEACHERS WHO HAVE COMPUTERS AT SCHOOL REPORTING USE OF COMPUTERS OR THE INTERNET FOR INSTRUCTION DURING CLASS TIME, BY SCHOOL AND TEACHER CHARACTERISTICS: 1999

School and teacher characteristics	Percent
All public school teachers	**53**
Instructional level	
Elementary	56
Secondary	44
Enrollment size	
Less than 300	56
300 to 999	56
1,000 or more	40
Locale	
City	48
Urban fringe	53
Town	56
Rural	56
Percent minority enrollment in school	
Less than 6 percent	56
6 to 20 percent	56
21 to 49 percent	52
50 percent or more	45
Percent of students in school eligible for free or reduced-price school lunch	
Less than 11 percent	63
11 to 30 percent	52
31 to 49 percent	54
50 to 70 percent	47
71 percent or more	50
Teaching experience	
3 or fewer years	50
4 to 9 years	54
10 to 19 years	50
20 or more years	54

NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the analyses presented in this table. These estimates have been revised from previously published estimates.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

minority students). Similarly, teachers in the lowest poverty schools (based on percent of students eligible for free or reduced-price school lunch) were more likely than teachers in schools with 50 to 70 percent eligible students to use computers or the Internet in this way (63 percent compared with 47 percent).

Project assignment. Overall 53 percent of public school teachers assigned projects using the computer or Internet *inside* of the classroom, and 48 percent of public school teachers assigned projects using the computer or Internet *outside* of the classroom (figure 2.5). The percent of

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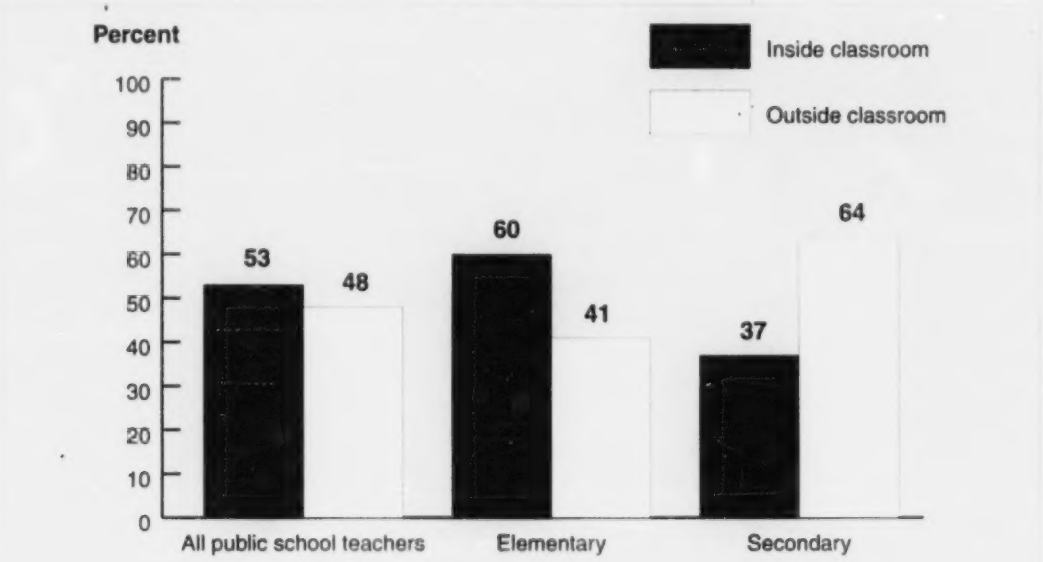
FIGURE 2.5.—PERCENT OF PUBLIC SCHOOL TEACHERS WHO HAVE COMPUTERS AT SCHOOL REPORTING ASSIGNING PROJECTS USING COMPUTERS, INSIDE AND OUTSIDE THE CLASSROOM, BY INSTRUCTIONAL LEVEL: 1999



NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the analyses presented in this figure.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

teachers assigning projects using the computer inside and outside of the classroom varied by the instructional level of the school. Elementary teachers were more likely than secondary teachers to assign projects using the computer *inside* the classroom (60 percent compared with 37 percent), and less likely than secondary teachers to assign projects using the computer *outside* of the classroom (41 percent compared with 64 percent).

Instructional activities. Public school teachers assigned students to use computers or the Internet for word processing/spreadsheets most frequently (61 percent did this to some extent), followed by Internet research (51 percent), practice drills (50 percent), solving problems and analyzing data (50 percent), CD-ROM research (48 percent), multimedia projects (45 percent), graphical presentations (43 percent), demonstration and simulation (39 percent), and correspondence with experts (23 percent—figure 2.6).

Differences by school and teacher characteristics. Teachers' use of technology for instructional activities varied by a number of school and teacher characteristics. For example, elementary teachers were more likely than secondary teachers to assign students to use computers or the Internet to practice drills (60 percent compared with 28 percent—table 2.4). In addition, elementary teachers were more likely than secondary teachers to assign students to use these technologies to solve problems and analyze data (54 percent compared with 41 percent). On the other hand, secondary teachers were more likely than elementary teachers to assign students to use these technologies to conduct research using the Internet (64 percent compared

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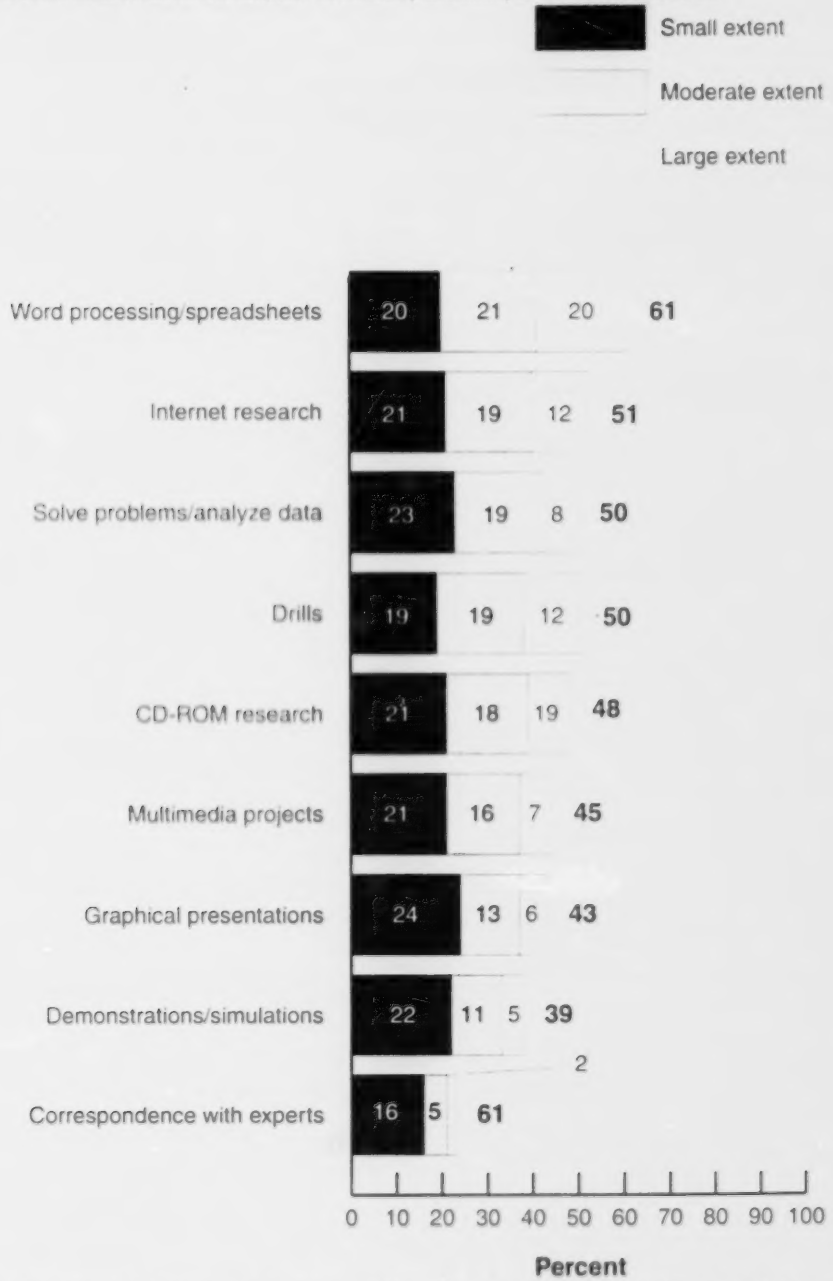
FIGURE 2.6.—PERCENT OF PUBLIC SCHOOL TEACHERS WHO HAVE COMPUTERS AT SCHOOL ASSIGNING STUDENTS DIFFERENT TYPES OF WORK USING COMPUTERS OR THE INTERNET TO A SMALL, MODERATE, OR LARGE EXTENT: 1999



NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the analyses presented in this figure. Detail may not sum to totals due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

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TABLE 2.4.—PERCENT OF PUBLIC SCHOOL TEACHERS WHO HAVE COMPUTERS AT SCHOOL ASSIGNING STUDENTS TO DO VARIOUS ACTIVITIES WITH COMPUTERS OR THE INTERNET TO ANY EXTENT, BY SCHOOL AND TEACHER CHARACTERISTICS: 1999

School and teacher characteristics	Activities				
	Word processing/ spreadsheets	Internet research	Drills	Solve problems/ analyze data	CD-ROM research
All public school teachers	**61**	**51**	**50**	**50**	**48**
Instructional level					
Elementary	60	44	60	54	48
Secondary	62	64	28	41	47
Enrollment size					
Less than 300	57	48	53	51	50
300 to 999	63	50	57	53	50
1,000 or more	56	54	28	39	43
Locale					
City	57	49	49	47	43
Urban fringe	63	50	49	51	50
Town	59	50	49	51	46
Rural	64	55	54	49	54
Percent minority enrollment in school					
Less than 6 percent	66	57	55	55	55
6 to 20 percent	61	52	51	50	50
21 to 49 percent	61	51	47	48	48
50 percent or more	53	41	47	45	38
Percent of students in school eligible for free or reduced-price school lunch					
Less than 11 percent	70	61	49	47	54
11 to 30 percent	65	56	54	55	53
31 to 49 percent	60	54	45	50	49
50 to 70 percent	54	45	51	49	46
71 percent or more	53	35	51	43	37
Teaching experience					
3 or fewer years	64	54	48	49	47
4 to 9 years	65	54	52	52	52
10 to 19 years	56	47	50	49	45
20 or more years	60	50	50	49	49

See note at end of table.

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TABLE 2.4.—PERCENT OF PUBLIC SCHOOL TEACHERS WHO HAVE COMPUTERS AT SCHOOL ASSIGNING STUDENTS TO DO VARIOUS ACTIVITIES WITH COMPUTERS OR THE INTERNET TO ANY EXTENT, BY SCHOOL AND TEACHER CHARACTERISTICS: 1999—CONTINUED

School and teacher characteristics	Activities			
	Multimedia projects	Graphical presentations	Demonstrations/ simulations	Correspondence with experts
All public school teachers	**45**	**44**	**39**	**23**
Instructional level				
Elementary	43	42	38	23
Secondary	48	47	40	23
Enrollment size				
Less than 300	39	43	37	22
300 to 999	46	44	39	23
1,000 or more	46	44	39	25
Locale				
City	44	44	39	25
Urban fringe	46	44	41	23
Town	42	38	36	23
Rural	46	43	38	24
Percent minority enrollment in school				
Less than 6 percent	49	45	40	26
6 to 20 percent	48	45	41	26
21 to 49 percent	46	46	40	24
50 percent or more	36	36	34	18
Percent of students in school eligible for free or reduced-price school lunch				
Less than 11 percent	55	52	44	28
11 to 30 percent	46	45	41	25
31 to 49 percent	47	43	41	27
50 to 70 percent	44	41	35	22
71 percent or more	33	37	36	14
Teaching experience				
3 or fewer years	44	41	39	17
4 to 9 years	50	47	41	25
10 to 19 years	44	44	40	27
20 or more years	43	42	37	22

NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the analyses presented in this table.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

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with 44 percent).

Teachers in schools with different enrollment sizes varied with respect to whether they assigned students to use computers or the Internet for various instructional activities. Teachers in schools with smaller enrollments were nearly twice as likely as teachers in schools with large enrollments to assign students to use these technologies to practice drills (53 percent of teachers in schools with less than 300 students and 57 percent with 300 to 999 students compared with 28 percent of teachers in schools with 1,000 or more students). Teachers in schools with smaller enrollments were also more likely than teachers in schools with the largest enrollments to assign students to use computers or the Internet to solve problems and analyze data (51 percent of teachers in schools with less than 300 students and 53 percent with 300 to 999 students compared with 39 percent of teachers in schools with 1,000 or more students).

There were also differences in whether teachers assigned students to use technology for various instructional activities according to minority enrollment. For example, teachers in schools enrolling the smallest proportion of minority students were more likely to assign students to use these technologies for word processing and creating spreadsheets than teachers in the highest minority enrollment schools (66 percent in schools with less than 6 percent minority enrollments compared with 53 percent of teachers in schools with 50 percent or more minority enrollments).

Teachers in lower minority enrollment schools were also generally more likely than teachers in the highest minority enrollment schools to assign students to use these technologies for multimedia presentations (49 percent of teachers in schools with less than 6 percent minority enrollments and 48 percent in schools with 6 to 20 percent minority enrollments compared with 36 percent of teachers in schools with 50 percent or more minority enrollments) and CD-ROM research (55 percent of teachers in schools with less than 6 percent minority enrollments and 50 percent in schools with 6 to 20 percent minority enrollments compared with 38 percent of teachers in schools with 50 percent or more minority enrollments). Finally, teachers in schools with smaller proportions of minority enrollments were more likely to use computers or the Internet for Internet research (57 percent of teachers in schools with less than 6 percent minority enrollments and 52 percent in schools with 6 to 20 percent minority enrollments compared with 41 percent of teachers in schools with 50 percent or more minority enrollments).

Similar to the differences in minority enrollment, school poverty concentration is related to a number of activities for which teachers assign students to use computers or the Internet. Teachers in schools with the lowest poverty concentrations were more likely than teachers in schools with the highest poverty concentrations to assign students to use these technologies for graphical presentations, multimedia presentations, word processing and spreadsheets, research using CD-ROM and the Internet, and corresponding with experts. For example, 52 percent of teachers in schools with less than 11 percent of students eligible for free or reduced-price school lunch assigned students to use these technologies for graphical presentations compared with 37 percent of teachers in schools with 71 percent or more students eligible for free or reduced-price school lunch.

Chapter 3

Availability of Technology For Instructional Purposes

Highlights

- The availability of educational technology increased substantially during the 1990s, particularly at the school level. By 1999, most teachers reported having at least one computer in their classrooms, and over half of these teachers also had access to the Internet in their classrooms. Additionally, the majority of teachers also reported having these technologies available at home.

- Despite the gains in computer and Internet availability at school and in classrooms, approximately one-third of teachers reported that their classrooms had a single computer or a single computer connected to the Internet available in 1999. In addition, the availability of technology was not equally distributed among schools with different characteristics. For example, teachers in schools with lower minority enrollments were generally more likely than teachers in schools with the highest minority enrollments to report having the Internet available in the classroom. Additionally, teachers in schools with lower poverty concentrations (based on the percent of students eligible for free or reduced-lunch) were generally more likely than teachers in schools with high minority concentrations to report having the Internet available in the classroom.

- In 1999, the availability of technology in the classroom was related to teachers' use of that technology. For example, teachers who reported having more than five computers in their classrooms were more likely than teachers with fewer classroom computers to report using computers a lot for various preparatory activities. Additionally, teachers who had more computers available in the classroom were generally more likely to report assigning students to use computers or the Internet to a large extent to conduct various tasks (e.g., solve problems or analyze data).

CHAPTER 3

Availability of Technology for Instructional Purposes

This chapter reviews data collected by several surveys on the availability of education technology to teachers and their students. The chapter begins with background information on computer availability from the National Assessment of Educational Progress (NAEP) school surveys, as well as from the Fast Response Survey System (FRSS) school survey, NAEP teacher survey, and the Current Population Survey (CPS) from 1994 to 1998. Data are also provided from the 1994 to 1999 FRSS school surveys on the percent of schools and instructional rooms with Internet connections. This background information is followed by more recent, detailed findings on the technology available to teachers and their students, taken from the 1999 FRSS survey on teachers' use of technology. Included are differences in the availability of computers and Internet connections by characteristics of schools (e.g., instructional level, location of school, poverty concentration).

Availability of Computers and the Internet: 1990 to 1999

Measures of computer availability come in a variety of forms, including the percent of students who have varying numbers of computers available to them in their schools (NAEP), student-to-computer ratios in schools (FRSS), the percent of students who have computer labs and portable computers available to them (NAEP), the percent of students who have computers permanently available in the classroom (NAEP), and the percent of students for whom computers are best described as available in computer labs or available in the classroom (NAEP). Measures of Internet availability in public schools are similar, but typically focus on the percent of schools connected to the Internet rather than on the percent of students with the Internet available to them. These measures include the percent of schools connected to the Internet

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(FRSS), the percent of instructional rooms connected to the Internet (FRSS), and student-to-instructional-computers-with-Internet ratios in schools (FRSS).

Computer Availability : 1990 to 1999

Number of computers available to students and student-to-computer ratios. Beginning in 1990, NAEP began collecting data from school administrators on the number of computers available to students in the school. Results from these surveys demonstrate a substantial increase in the number of computers available to public school students in their schools between 1990 and 1999 (figure 3.1). For example, the percent of fourth-grade students who had more than 76 computers available in their schools rose from 1 percent in 1990 to 33 percent in 1998. Similarly, there was an increase from 8 percent to 51 percent of eighth-grade students and from 42 percent to 73 percent of twelfth-grade students during those years. According to recent FRSS data, approximately one computer was available for every six students in 1999 (Williams, 2000).

Computer availability in labs and classrooms. Data are also available from the NAEP 1998 school survey on the location of computers in the school. For example, administrators indicated if the school had computer labs and whether computers were always available in classrooms. Additionally, administrators were asked if computers were available to be brought to classrooms for student use as a measure of portable computer availability.

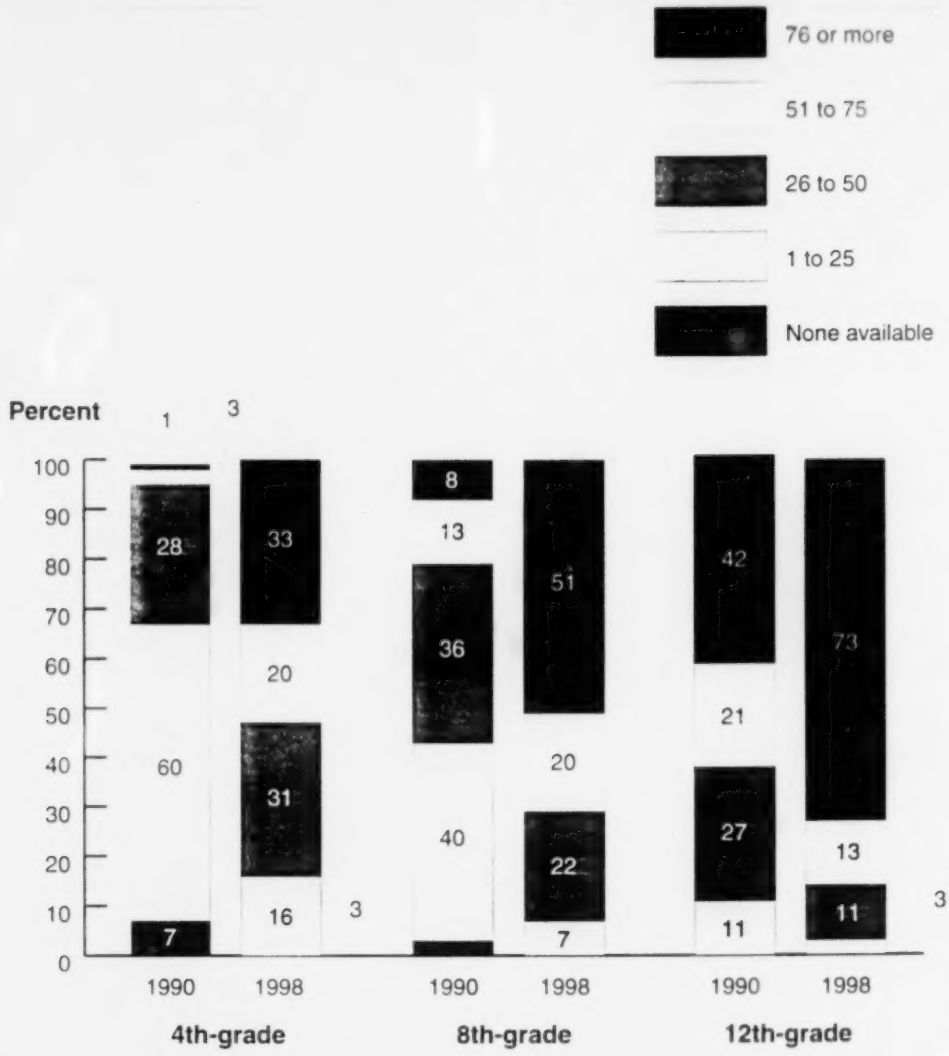
The different types of computer availability (e.g., labs, available to be brought to class, classrooms) varied by grade-level in 1998. For example, among public school students, eighth and twelfth-grade students were more likely than fourth-grade students to have computer labs available (90 percent and 94 percent, respectively, compared with 78 percent—figure 3.2). Conversely, fourth-grade students were more likely to have computers always available in the classroom than eighth and twelfth-grade students (83 percent compared with 46 percent and 27 percent, respectively).

Teachers' reports of computer availability to students. In 1998, public school teachers of fourth- and eighth-grade students were asked to best describe the availability of computers for use by their students. Teachers reported whether: computers were "not available to students anywhere," computers for student use were "available in a lab," or varying numbers of computers for student use were "available in class." According to their teachers, the majority of both fourth-grade and eighth-grade students had computers available to them somewhere in their school in 1998, either in the classroom or elsewhere in the school (figure 3.3). Specifically, 72 percent of fourth-grade students and 49 percent of eighth-grade students had at least one computer in their classrooms, and 23 percent of fourth-grade students and 42 percent of eighth-grade students had at least one computer available in lab. Thus, 5 percent of fourth-graders and 9 percent of eighth-graders did not have computers available in their schools.

Internet Availability: 1994 to 1999

The FRSS also collected data on the percent of public schools and instructional rooms that were connected to the Internet as part of its school surveys between 1994 and 1999. Internet

FIGURE 3.1.—PERCENT OF PUBLIC SCHOOL 4TH-, 8TH-, AND 12TH-GRADE STUDENTS WHO HAD SCHOOL ADMINISTRATORS REPORTING VARYING NUMBERS OF COMPUTERS AT THE SCHOOL: 1990 AND 1998



NOTE: Detail may not sum to 100 due to rounding.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1990 and 1998 Reading Assessments.

availability in schools and instructional rooms increased steadily during that time (Williams, 2000—figure 3.4). In 1994, a little over a third of all public schools were connected to the Internet. By 1999, availability had grown to 95 percent, with one computer connected to the Internet for every 9 students. The percent of instructional rooms connected to the Internet grew even more sharply during that time—whereas 3 percent of instructional rooms were connected to the Internet in 1994, 63 percent were connected by 1999.

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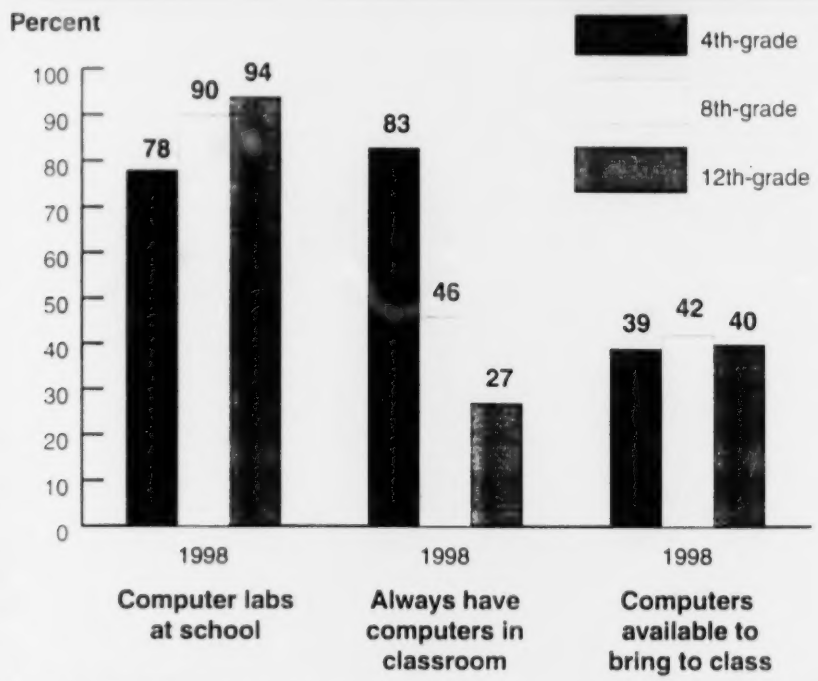
FIGURE 3.2.—PERCENT OF PUBLIC SCHOOL 4TH-, 8TH-, AND 12TH-GRADE STUDENTS WHO HAD SCHOOL ADMINISTRATORS REPORTING COMPUTER LABS AT SCHOOL, COMPUTERS IN THE CLASSROOM, OR COMPUTERS AVAILABLE TO BRING TO CLASS: 1998



SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1998 Reading Assessments.

Differences in the Growth of Availability

Despite the gains made by public schools in obtaining computers and Internet connectivity, not all schools had made the same progress by 1999 (Williams, 2000). The 1999 FRSS data indicate differences in student-to-instructional-computer ratios by such school characteristics as enrollment size, location, poverty concentration, and minority enrollments. For example, the smallest schools had a lower student-to-instructional-computer ratio than medium and large schools (4 compared with 6 each), as well as a lower student-to-instructional-computer-with-Internet ratio (6 compared with 9 and 10, respectively—figure 3.5). Rural schools had a lower student-to-instructional-computer ratio than schools in other locations (4 compared with 6 each for schools located in urban fringes, cities, and towns). Furthermore, rural schools had lower student-to-instructional-computer-with-Internet ratios than urban fringe and city schools (7 compared with 9 and 11, respectively).

Additionally, there were differences in student-to-instructional-computer ratios by poverty concentration and minority enrollments in 1999. Higher poverty schools (31 to 49 percent of students eligible for free or reduced-price lunch) had more students per instructional computer

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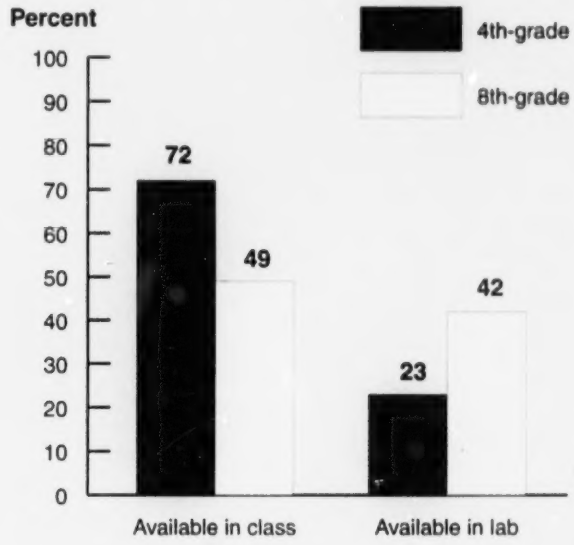
FIGURE 3.3.—PERCENT OF PUBLIC SCHOOL 4TH- AND 8TH-GRADE STUDENTS HAVING TEACHERS REPORTING COMPUTERS AVAILABLE IN THEIR CLASSES OR LABS AS THEIR BEST COMPUTER AVAILABILITY: 1998



SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1998 Reading Assessments.

than lower poverty schools (11 to 30 percent and less than 11 percent of students eligible for free or reduced-price lunch—6 compared with 5 each). Similarly, schools with the highest minority enrollments had a higher student-to-instructional-computer ratio than schools with lower minority enrollments (6 to 20 percent or less than 6 percent minority enrollments—6 compared with 5 each).

Differences by poverty concentration and minority enrollments were also present in student-to-instructional-computer-with-Internet ratios. Schools with more than 70 percent of students eligible for free or reduced-price lunch had more students per instructional computer with Internet than schools with lower poverty concentrations (31 to 49 percent, 11 to 30 percent, and less than 11 percent—16 compared with 9, 8, and 7, respectively). Similarly, schools with the highest minority enrollments had a higher student-to-instructional-computer-with-Internet ratio than schools with lower minority enrollments (21 to 49 percent, 6 to 20 percent, and less than 6 percent—13 compared with 9, 8, and 7, respectively).

The highest poverty schools were also less likely to report having instructional rooms connected to the Internet than several other groups in 1997 and 1998 (Rowand, 1999; Williams, 2000—figure 3.6). Between 1998 and 1999, all schools except those with the highest poverty concentrations reported an increase in the percentage of instructional rooms connected to the Internet. In 1999, 39 percent of instructional rooms at schools with more than 70 percent of students eligible for free or reduced-price lunch were connected to the Internet, compared with 62 to 74 percent of schools with lower concentrations of poverty.

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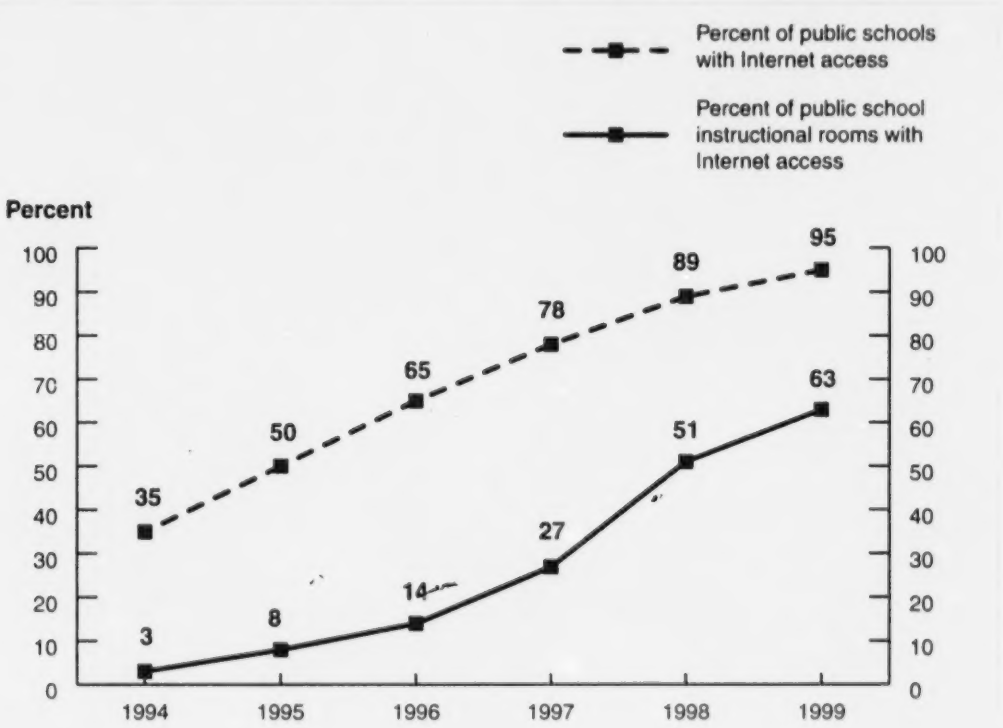
FIGURE 3.4.—PERCENT OF PUBLIC SCHOOLS AND INSTRUCTIONAL ROOMS WITH INTERNET ACCESS: 1994 TO 1999



SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Advanced Telecommunications in Public Schools, K-12," FRSS 51, NCES 95-731; "Advanced Telecommunications in U.S. Public Elementary and Secondary Schools, 1995," FRSS 57, NCES 96-854; "Advanced Telecommunications in U.S. Elementary and Secondary Public Schools, Fall 1996," FRSS 61, NCES 97-944; "Internet Access in Public Schools," FRSS 64, NCES 98-031; "Survey on Internet Access in U.S. Public Schools, Fall 1998," FRSS 69, 1998; and "Internet Access in U.S. Public Schools and Classrooms: 1994-99," FRSS 75, NCES 2000-086.

Availability of Computers at Home: 1994 to 1998

Data are also available on the presence of computers in public and private school teachers' and students' homes, collected as part of the CPS. The following sections describe the growth in the availability of home computers among elementary and secondary public and private school teachers and students between 1994 and 1998. The availability of computers in teachers' homes is compared with that of adults in other occupations, and the number and ages of computers in the home are also given for the most recent year (1998).

Teachers' Computer Availability at Home

Results from the 1994 to 1998 CPS indicate that the availability of computers in public and private school teachers' homes increased significantly between 1994 and 1998 (54 percent compared with 74 percent). Furthermore, elementary and secondary teachers were more likely to have a computer at home than adults in all other occupations in 1994 through 1998 (e.g., 74 percent compared with 46 percent in 1998—figure 3.7). The majority of adults who had a

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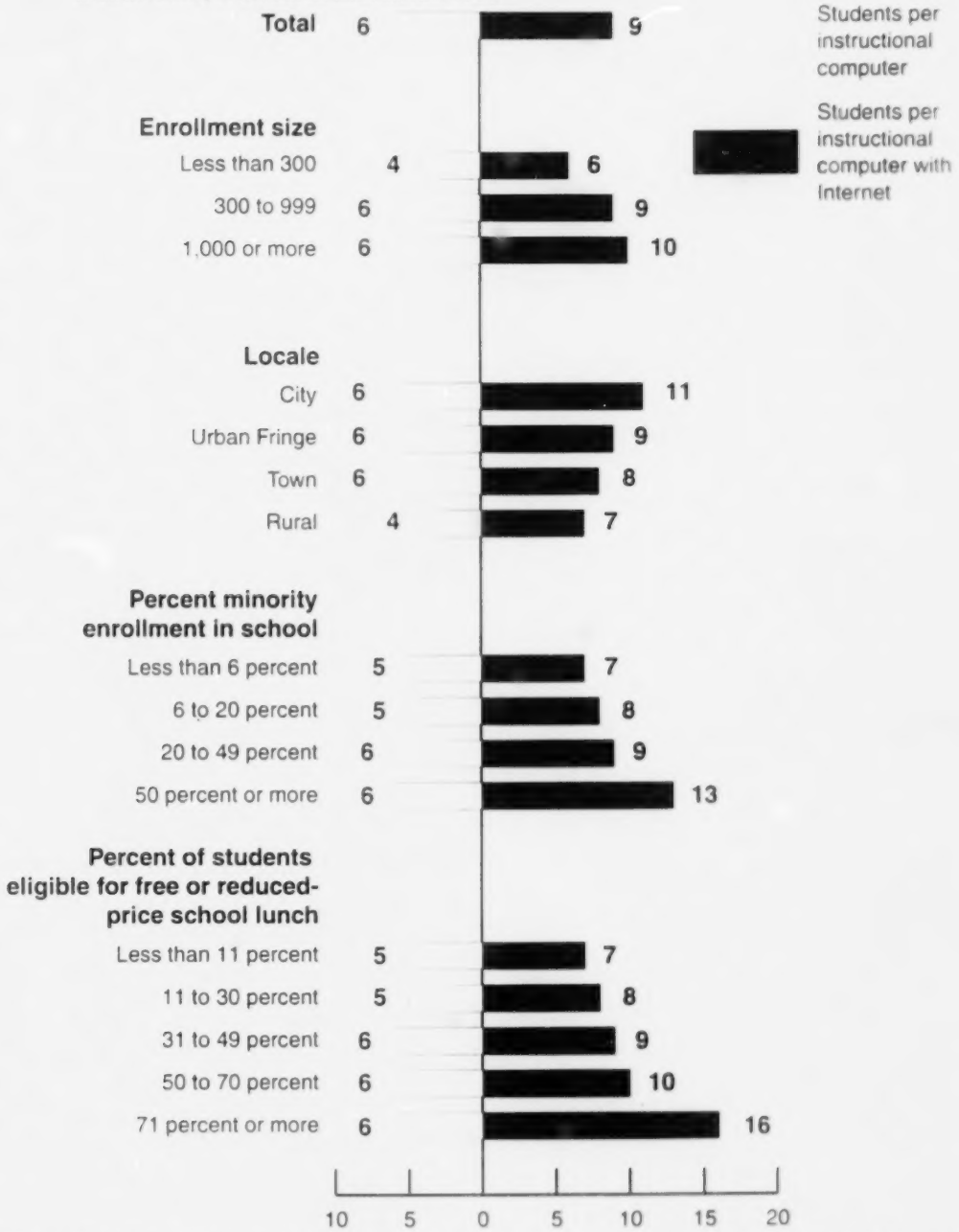
FIGURE 3.5.—RATIO OF STUDENTS PER INSTRUCTIONAL COMPUTER AND STUDENTS PER INSTRUCTIONAL COMPUTER WITH INTERNET ACCESS, BY SCHOOL CHARACTERISTICS: 1999


Students per instructional computer
Students per instructional computer with Internet
Total 6 9
Enrollment size
Less than 300 4 6
300 to 999 6 9
1,000 or more 6 10
Locale
City 6 11
Urban Fringe 6 9
Town 6 8
Rural 4 7
Percent minority enrollment in school
Less than 6 percent 5 7
6 to 20 percent 5 8
20 to 49 percent 6 9
50 percent or more 6 13
Percent of students eligible for free or reduced-price school lunch
Less than 11 percent 5 7
11 to 30 percent 5 8
31 to 49 percent 6 9
50 to 70 percent 6 10
71 percent or more 6 16
10 5 0 5 10 15 20

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Survey on Internet Access in U.S. Public Schools, Fall 1999," FRSS 75, 1999.

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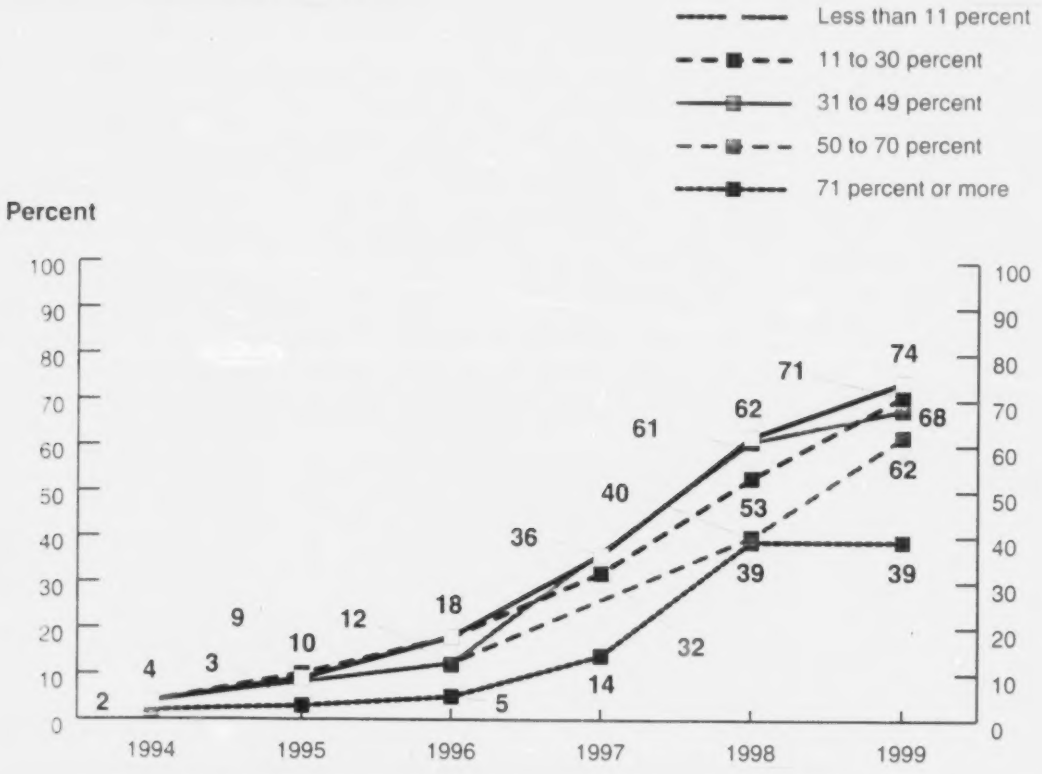
FIGURE 3.6.—PERCENT OF PUBLIC SCHOOL INSTRUCTIONAL ROOMS WITH INTERNET ACCESS, BY FREE OR REDUCED-PRICE LUNCH ELIGIBILITY: 1994 TO 1999



NOTE: In 1995 and 1997 the 31 to 49 percent and 50 to 70 percent categories were collapsed. Separate estimates are unavailable for those years.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Advanced Telecommunications in Public Schools, K-12," FRSS 51, NCES 95-731; "Advanced Telecommunications in U.S. Public Elementary and Secondary Schools, 1995," FRSS 57, NCES 96-854; "Advanced Telecommunications in U.S. Elementary and Secondary Public Schools, Fall 1996," FRSS 61, NCES 97-944; "Internet Access in Public Schools," FRSS 64, NCES 98-031; "Internet Access in Public Schools and Classrooms, 1994-1998," FRSS 69, NCES 1999-017; and "Internet Access in U.S. Public Schools and Classrooms: 1994-99," FRSS 75, NCES 2000-086.

computer in the home in 1998 reported having one computer (71 percent of teachers with computers and 75 percent of adults in other occupations); fewer had two computers (20 percent of teachers and 18 percent of adults in other occupations). Additionally, in 1998, most teachers and adults in other occupations reported having computers that were three years old or newer (71 percent of teachers and 75 percent of adults in other occupations with computers—table A-3.9).

Students' Computer Availability at Home

The CPS also collected data on public and private school students' computer availability at home in 1994 to 1998. According to these data, the percent of students who had at least one computer in the home increased from 36 percent in 1994 to 56 percent in 1998 (table A-3.9).

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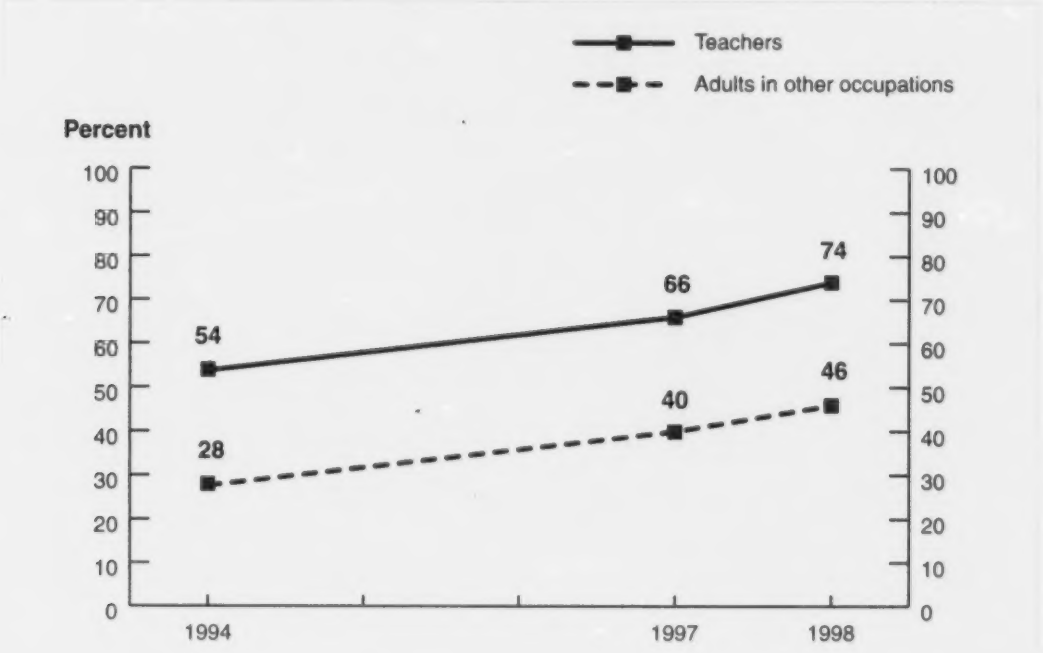
FIGURE 3.7.—PERCENT OF ELEMENTARY AND SECONDARY TEACHERS AND ADULTS IN OTHER OCCUPATIONS WHO REPORT HAVING COMPUTERS AT HOME: 1994, 1997, AND 1998



NOTE: Adults in other occupations includes all survey respondents who reported an occupation which was not elementary or secondary teacher.

SOURCE: U.S. Census Bureau, Current Population Survey, November 1994, October 1997, December 1998.

Availability of Technology to Teachers and Students in 1999

The remaining sections of this chapter describe teachers' reports of the availability of computers in public school teachers' schools and classrooms followed by the availability of the Internet in these locations, and the availability of both computers and the Internet at home. Finally, the relationship between computer availability in the classroom and teachers' computer-related activities is explored.

Computer Availability in the School

Nearly all public school teachers (99 percent) reported having computers available somewhere in their schools in 1999 (table A-3.9). Eighty-four percent of public school teachers had computers available in their classrooms (table 3.1), and 95 percent of teachers had computers available elsewhere in the school.[1]

Number of computers in the classroom. In addition to asking teachers if they had computers available in the classrooms, the 1999 FRSS survey also asked for the *number* of computers

[1] These two categories were not mutually exclusive.

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TABLE 3.1.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING COMPUTER AVAILABILITY IN THE CLASSROOM AND ELSEWHERE IN SCHOOL, BY SCHOOL CHARACTERISTICS: 1999

School characteristics	Computers available in classroom		Computers available elsewhere in school	
	Yes	No	Yes	No
All public school teachers	**84**	**16**	**95**	**5**
Instructional level				
Elementary	89	11	93	7
Secondary	75	25	99	1
Enrollment size				
Less than 300	87	13	89	11
300 to 999	88	12	95	5
1,000 or more	71	29	97	3
Locale				
City	80	20	94	6
Urban fringe	83	17	95	5
Town	92	8	93	7
Rural	87	13	97	3
Percent minority enrollment in school				
Less than 6 percent	85	15	94	6
6 to 20 percent	86	14	95	5
21 to 49 percent	89	11	96	4
50 percent or more	77	23	95	5

NOTE: Detail may not sum to 100 due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

available in the classroom. As previously indicated, most public school teachers (84 percent) reported having at least one computer in their classrooms in 1999 (table 3.1). Thirty-six percent had one computer in their classrooms, 38 percent reported having two to five computers in their classrooms, and 10 percent reported having more than five computers in their classrooms (table 3.2).

Differences in school and classroom computer availability by school characteristics. Teachers' computer availability in 1999 varied by several school characteristics, including instructional level, enrollment size, location, minority enrollments, and poverty concentration. Elementary teachers were more likely to have computers in their classrooms (89 percent) than secondary teachers (75 percent—table 3.1). Teachers in schools enrolling less than 300 and 300 to 999 students were more likely to have computers in their classrooms (87 and 88 percent, respectively) than teachers in schools with the largest enrollments (71 percent). Furthermore, teachers in schools

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located in towns were more likely to have computers located in their classrooms than teachers in schools located in cities and in urban fringes (92 percent compared with 80 percent and 83 percent, respectively). Last, teachers in schools with 21 to 49 percent minority enrollments were more likely to have computers in the classroom than teachers in schools with 50 percent or more minority enrollments (89 percent of teachers compared with 77 percent of teachers).

There were also differences among teachers who had varying *numbers* of computers in the classroom (table 3.2). Not only were some groups of teachers less likely to have computers in their classrooms (e.g., teachers in secondary schools or large schools), but they were also more likely than other teachers to have only one computer in their classrooms. Teachers in secondary schools were more likely to have one computer than elementary teachers (45 percent compared with 33 percent), and less likely to have two to five computers than elementary teachers (20 percent compared with 46 percent).

Computer availability also varied by school size. For example, teachers in schools enrolling 1,000 or more students were more likely to report having one computer in their classrooms than teachers in schools with less than 300 students (41 percent compared with 28 percent). Teachers in schools enrolling 1,000 or more students were less likely, however, to report having two to five computers than either schools enrolling 300 to 999 students or schools enrolling less than 300 students (20 percent compared with 43 percent and 46 percent, respectively).

Internet Availability at School

Sixty-four percent of public school teachers who reported having computers in their classrooms also reported having Internet availability in their classrooms in 1999. Ninety percent of teachers who reported having computers available elsewhere in their schools also reported that the Internet was available elsewhere in the school (table 3.3).[2]

Number of classroom computers connected to the Internet. Among the teachers who reported having computers available in their classrooms, approximately one-third had no computers connected to the Internet and about half had one computer connected to the Internet (figure 3.8). It was less commonly reported that teachers had two to five computers connected or more than five computers connected to the Internet (13 percent and 4 percent, respectively).

Differences in school and classroom Internet availability by school characteristics. There were differences in overall Internet availability (in class or elsewhere in the school) and in the number of classroom computers connected to the Internet by several school characteristics. For example, secondary teachers with computers in their classrooms were more likely to have Internet availability in their classrooms (72 percent) than elementary teachers (60 percent—table 3.3). As indicated previously, elementary teachers were more likely to have computers in their classrooms than secondary teachers; this indicates that although elementary teachers were more likely to have computers in their classrooms, secondary teachers were more likely to have the

[2] These two categories were not mutually exclusive.

TABLE 3.2.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING VARYING NUMBERS OF COMPUTERS AVAILABLE IN THE CLASSROOM, BY SCHOOL CHARACTERISTICS: 1999

School characteristics	Number of computers available in the classroom			
	None	One	2-5	More than 5
All public school teachers	**16**	**36**	**38**	**10**
Instructional level				
Elementary	11	33	46	10
Secondary	25	45	20	10
Enrollment size				
Less than 300	13	28	46	12
300 to 999	12	36	43	9
1,000 or more	29	41	20	10
Locale				
City	20	34	37	9
Urban fringe	17	35	38	10
Town	8	43	38	11
Rural	13	37	38	11
Percent minority enrollment in school				
Less than 6 percent	16	34	40	10
6 to 20 percent	13	40	38	9
21 to 49 percent	11	39	40	10
50 percent or more	23	33	35	10
Percent of students in school eligible for free or reduced-price school lunch				
Less than 11 percent	13	42	35	9
11 to 30 percent	16	36	38	10
31 to 49 percent	16	37	38	9
50 to 70 percent	13	38	38	11
71 percent or more	18	32	40	11

NOTE: Detail may not sum to 100 due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Internet available on the computers that they did have in their classrooms. Furthermore, among teachers who reported having computers available elsewhere in the school, secondary teachers were also more likely to have Internet availability elsewhere in the school than were elementary teachers (96 percent compared with 87 percent).

Additionally, teachers in schools located in towns were more likely to have Internet availability elsewhere in the school (96 percent) than teachers in urban fringe schools or city schools (87 percent and 90 percent, respectively). Moreover, teachers in schools with less than 6 percent or 6 to 20 percent minority enrollments were more likely to have the Internet available in the

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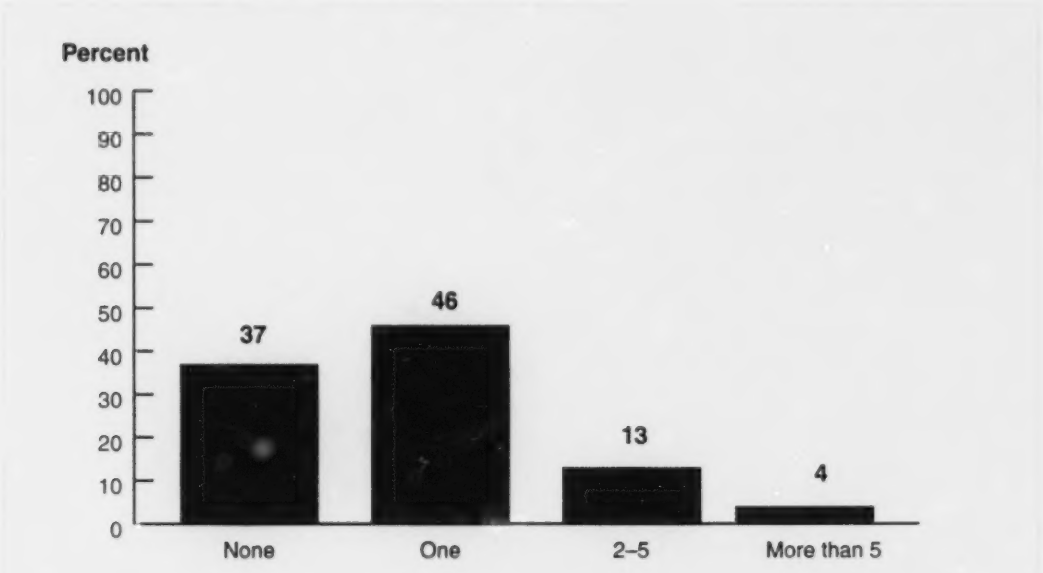
FIGURE 3.8.—PERCENT OF PUBLIC SCHOOL TEACHERS HAVING VARYING NUMBERS OF COMPUTERS CONNECTED TO THE INTERNET WHEN THERE ARE COMPUTERS IN THE CLASSROOM: 1999



NOTE: Teachers who reported that computers were not available to them in the classroom were excluded from the analysis presented in this figure.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

classroom than teachers in schools with 50 percent or more minority enrollments (69 percent and 71 percent compared with 51 percent). Similarly, teachers in schools with lower minority enrollments were generally more likely to report this availability elsewhere in the school than teachers in schools with the highest minority enrollments (93 percent of teachers in schools with 6 to 20 percent minority enrollments and 92 percent of teachers in schools with 21 to 49 percent minority enrollments, compared with 83 percent of teachers in schools with 50 percent or more minority enrollments).

Internet availability also varied by poverty concentration. For example, public school teachers in schools where 11 to 30 percent and 31 to 49 percent of the students qualify for free or reduced-price lunch were more likely to have the Internet available in the classroom than teachers in schools with 71 percent or more students eligible (71 percent each compared with 51 percent). Teachers in lower poverty schools were also generally more likely than teachers in the highest poverty schools to have Internet available elsewhere in the school. Specifically, teachers in schools with less than 11 percent, 11 to 30 percent, and 31 to 49 percent students eligible for free or reduced-price lunch were more likely to have this availability than teachers in schools with 71 percent or more students eligible (92 to 93 percent, compared with 80 percent of teachers).

As with overall Internet availability in the classroom, the number of classroom computers that public school teachers reported as having Internet connections varied by instructional level and

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minority enrollments, but not percent of students eligible for free or reduced-price lunch (table 3.4). For example, secondary teachers were more likely than elementary teachers to have either one computer connected to the Internet (55 percent compared with 43 percent) or more than five computers connected (6 percent compared with 3 percent).

In addition, teachers in schools with 6 to 20 percent minority enrollments were more likely than teachers in schools with 50 percent or more minority enrollments to have one computer

TABLE 3.3.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING INTERNET AVAILABILITY IN THE CLASSROOM AND ELSEWHERE IN SCHOOL, BY SCHOOL CHARACTERISTICS: 1999

School characteristics	Internet available in classroom		Internet available elsewhere in school	
	Yes	No	Yes	No
All public school teachers	**64**	**36**	**90**	**10**
Instructional level				
Elementary	60	40	87	13
Secondary	72	28	96	4
Enrollment size				
Less than 300	67	33	93	7
300 to 999	62	38	89	11
1,000 or more	67	33	91	9
Locale				
City	60	40	90	10
Urban fringe	64	36	87	13
Town	67	33	96	4
Rural	65	35	92	8
Percent minority enrollment in school				
Less than 6 percent	69	31	92	8
6 to 20 percent	71	29	93	7
21 to 49 percent	62	38	92	8
50 percent or more	51	49	83	17
Percent of students in school eligible for free or reduced-price school lunch				
Less than 11 percent	67	34	92	8
11 to 30 percent	71	29	93	7
31 to 49 percent	71	29	93	7
50 to 70 percent	55	45	87	13
71 percent or more	51	49	80	20

NOTE: Teachers who reported that computers were not available to them in the classroom were excluded from the "Internet available in classroom" analyses presented in this table. Teachers who reported that computers were not available to them elsewhere in the school were excluded from the "Internet available elsewhere in school" analyses presented in this table. Detail may not sum to 100 due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

connected to the Internet (55 percent compared with 39 percent). Moreover, teachers in schools with less than 6 percent minority enrollments were more likely to report having two to five computers connected than teachers in schools with 50 percent or more minority enrollments (19 percent compared with 9 percent).

E-mail Availability in School

Public school teachers were asked whether e-mail was available in their schools in 1999. Among those who reported having any computers available in their schools, 74 percent indicated that e-mail was also available (table 3.5). E-mail availability varied by location of school, minority enrollments, and poverty concentration. Rural teachers were more likely to report e-mail availability (81 percent) than city teachers (70 percent). Moreover, teachers in schools with lower minority enrollments were more likely to report that e-mail was available than teachers in schools with the highest minority enrollments (78 percent of teachers in schools with less than 6 percent minority enrollments, 80 percent in schools with 6 to 20 percent minority enrollments, and 74 percent in schools with 21 to 49 percent minority enrollments, compared with 62 percent of teachers in schools with 50 percent or more minority enrollments). Furthermore, teachers in schools with less than 11 percent, 11 to 30 percent, and 31 to 49 percent students eligible for free or reduced-price lunch were more likely to have e-mail available than teachers in schools with more than 70 percent eligible students (76 percent, 78 percent, and 80 percent of teachers, compared with 61 percent).

Availaility at Home: Computers, Internet, and School Network

Teachers' Computer, Internet, and School Network Availability at Home

As reported earlier, results of the 1998 CPS indicate that 74 percent of elementary and secondary public and private school teachers had a computer at home. According to the 1999 FRSS survey of teachers' technology use, 82 percent of public school teachers reported having a computer at home (table 3.6). The 1999 FRSS teacher survey also asked teachers if they had the Internet available at home, and if their school had a network that they could access at home. Sixty-three percent of public school teachers reported having the Internet available at home in 1999. In addition, 27 percent reported that their school had a network that they could use to access the Internet from home.

There were several differences in teachers' availability of computers and the Internet at home by school characteristics in 1999. For example, teachers in schools with 1,000 students or more enrolled were more likely to have a computer at home than teachers in schools with less than 300 students enrolled (86 percent compared with 74 percent). Similarly, teachers in schools with 300 to 999 students enrolled and schools with 1,000 or more students enrolled were more likely to have Internet at home than teachers in schools with less than 300 students enrolled (64 percent and 65 percent, compared with 52 percent). Teachers in urban fringe schools and schools located in towns were more likely to have the Internet available at home

TABLE 3.4.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING VARYING NUMBERS OF COMPUTERS IN THE CLASSROOM WITH INTERNET CONNECTIONS, BY SCHOOL CHARACTERISTICS: 1999

School characteristics	Number of computers in the classroom with Internet			
	None	One	2-5	More than 5
All public school teachers	**37**	**46**	**13**	**4**
Instructional level				
Elementary	40	43	14	3
Secondary	29	55	11	6
Enrollment size				
Less than 300	33	48	14	4
300 to 999	38	44	14	4
1,000 or more	36	52	9	3
Locale				
City	41	41	15	3
Urban fringe	37	49	11	3
Town	32	50	14	4
Rural	35	46	14	5
Percent minority enrollment in school				
Less than 6 percent	31	46	19	3
6 to 20 percent	30	55	11	4
21 to 49 percent	39	45	13	4
50 percent or more	49	39	9	2
Percent of students in school eligible for free or reduced-price school lunch				
Less than 11 percent	34	47	14	5
11 to 30 percent	30	51	16	3
31 to 49 percent	29	51	15	5
50 to 70 percent	47	39	11	4
71 percent or more	49	39	9	3

NOTE: Teachers who reported that computers were not available to them in the classroom were excluded from the analyses presented in this table. Detail may not sum to 100 due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999

than rural school teachers (67 percent and 66 percent, compared with 53 percent). Furthermore, less than a third of all teachers reported having a school network that could be accessed from home, and teachers in the largest schools and the lowest poverty schools reported the highest network availability, compared with teachers in the smallest schools and the highest poverty schools.

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TABLE 3.5.—PERCENT OF PUBLIC SCHOOL TEACHERS HAVING E-MAIL AVAILABLE TO THEM AT SCHOOL, BY SCHOOL CHARACTERISTICS: 1999

School characteristics	E-mail available at school: Yes	No
All public school teachers	**74**	**26**
Locale		
City	70	30
Urban fringe	71	29
Town	79	21
Rural	81	19
Percent minority enrollment in school		
Less than 6 percent	78	22
6 to 20 percent	80	20
21 to 49 percent	74	26
50 percent or more	62	38
Percent of students in school eligible for free or reduced-price school lunch		
Less than 11 percent	76	24
11 to 30 percent	78	22
31 to 49 percent	80	20
50 to 70 percent	69	31
71 percent or more	61	39

NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the analyses presented in this table. Detail may not sum to 100 due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Students' Computer Availability at Home

Because 48 percent of the teachers surveyed in 1999 reported assigning projects using the computer outside of class, it is useful to know if students had the resources to complete these assignments at home. This section uses data from the 1999 FRSS teacher survey[3] to describe the availability of computers in students' homes during that year. Results of this survey indicate that 36 percent of the teachers reported that more than half of their students had computers at home (table 3.7). This means that 64 percent of teachers did *not* believe that the majority of their students had a computer available at home. The percent of teachers who reported that more than half of their students had computers at home varied by several school characteristics. For example, teachers in urban fringe schools were more likely to report that the majority of

[3] The FRSS data reported in this section are teachers' estimates of students' home computer availability, and therefore may not accurately reflect whether students had computers at home. Data from the 1998 CPS on the percent of students who reported having a computer at home were presented earlier in the chapter.

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TABLE 3.6.—PERCENT OF PUBLIC SCHOOL TEACHERS HAVING COMPUTERS AND THE INTERNET AVAILABLE TO THEM AT HOME, AND THE PERCENT OF TEACHERS HAVING A SCHOOL NETWORK THAT THEY CAN ACCESS FROM HOME, BY SCHOOL CHARACTERISTICS: 1999

School characteristics	Computer available at home		Internet available at home		School network accessible from home	
	Yes	No	Yes	No	Yes	No
All public school teachers	**82**	**18**	**63**	**37**	**27**	**73**
Enrollment size						
Less than 300	74	26	52	48	18	82
300 to 999	83	17	64	36	27	73
1,000 or more	86	14	65	35	29	71
Locale						
City	79	21	62	38	26	74
Urban fringe	86	14	67	33	29	71
Town	84	16	66	34	28	72
Rural	79	21	53	47	21	79
Percent of students in school eligible for free or reduced-price school lunch						
Less than 11 percent	85	15	70	30	36	64
11 to 30 percent	86	14	67	33	25	75
31 to 49 percent	83	17	57	43	28	72
50 to 70 percent	79	21	59	42	25	75
71 percent or more	79	21	59	41	20	80

NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the "School network accessible from home" analyses presented in this table. Detail may not sum to 100 due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

their students had computers at home than teachers in any other location (48 percent compared with 26 percent to 30 percent).

Teachers in schools with the highest minority enrollments (50 percent or more) were *less* likely to report that the majority of their students had computers at home than teachers in any other schools (9 percent as compared with 39 percent to 50 percent). In addition, teachers in the lower poverty schools (less than 71 percent of students eligible for free or reduced-price lunch) were more likely to report that their students had computers at home than teachers in the highest poverty schools (71 percent or more eligible students).

TABLE 3.7.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING THAT MORE THAN 50 PERCENT OF THEIR STUDENTS HAVE COMPUTERS AT HOME, BY SCHOOL CHARACTERISTICS: 1999

School characteristics	Percent of teachers reporting >50% of students have computers at home
All public school teachers	**36**
Enrollment size	
Locale	
City	26
Urban fringe	48
Town	29
Rural	30
Percent minority enrollment in school	
Less than 6 percent	44
6 to 20 percent	50
21 to 49 percent	39
50 percent or more	9
Percent of students in school eligible for free or reduced-price school lunch	
Less than 11 percent	72
11 to 30 percent	46
31 to 49 percent	34
50 to 70 percent	21
71 percent or more	2

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Teachers' Use of Technology and Computer Availability in their Classrooms

The push to increase the availability of technology in the classroom is based on the assumption that availability will increase students' and teachers' use of this technology, and that this use will lead to positive outcomes for students (U.S. Department of Education, 1996).[4] This section explores the relationship between the numbers of computers available in the classroom in 1999, and teachers' use of those computers for instructional purposes.

[4] The positive outcomes cited include increased job opportunity, learning experiences, and academic achievement (U.S. Department of Education, 1996). It should be noted, however, that disagreement exists in the research literature on the benefits of technology as it relates to academic achievement. Some studies report a positive relationship between the use of education technology and student achievement (e.g., Mann, Shakeshaft, Becker and Kottkamp, 1999; Wenglinsky, 1998), while others report marginal to no effect (e.g., Becker, 1990a; Clark, 1994).

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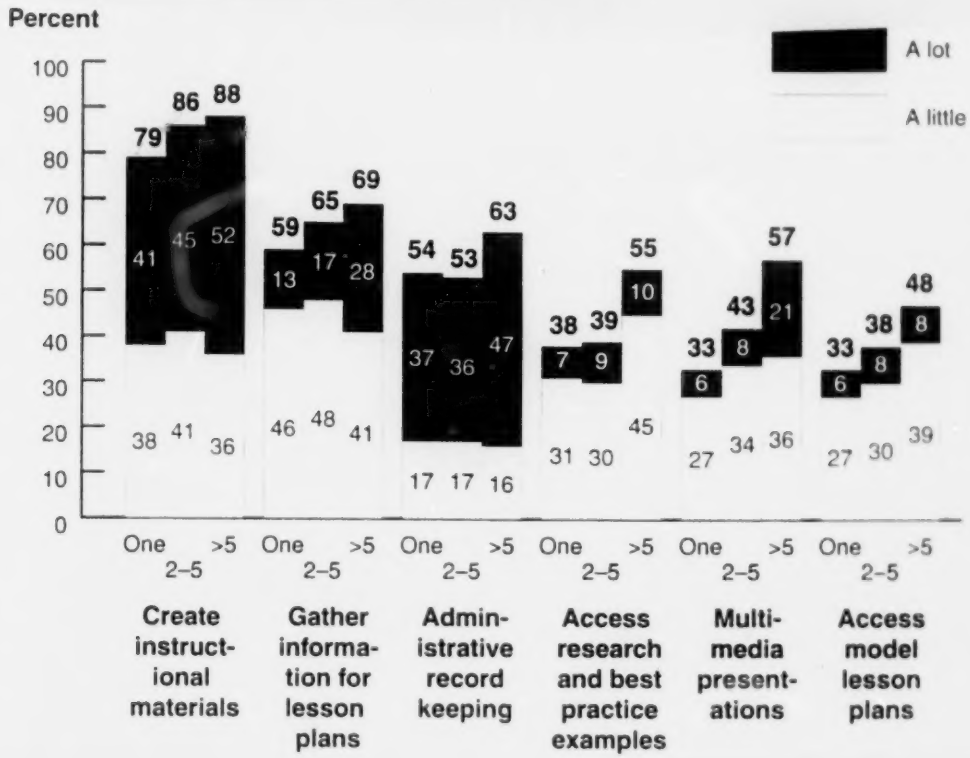
Preparatory Tasks and Computer Availability

Among teachers who reported having computers located in their classrooms, those who had more than 5 classroom computers were more likely than those with fewer classroom computers to report doing various preparatory activities "a lot" (figure 3.9). For example, 28 percent of teachers with more than five computers reporting using computers or the Internet a lot to gather information for lesson plans, compared with 17 percent of teachers with two to five computers and 13 percent of teachers with one computer. A similar relationship was found for using computers or the Internet a lot to prepare multimedia presentations.

Classroom Instruction and Computer Availability

Teachers' reports of assigning students to use computers or the Internet for various instructional purposes differed by the number of computers in their classrooms. For example, 59 percent of teachers with one computer in the classroom reported *not* assigning students to use computers or the Internet to solve problems or analyze data, compared with 40 percent of teachers with two to five computers and 23 percent of teachers with more than five computers (table 3.8). Conversely, teachers with more than five computers in their classrooms were most likely to report assigning problem solving or data analysis computer work to a "large extent," followed by teachers with two to five computers and teachers with one computer (21 percent compared with 9 percent and 5 percent, respectively). Similar relationships were found for word processing and practicing drills.

FIGURE 3.9.—PERCENT OF PUBLIC SCHOOL TEACHERS WHO REPORT USING COMPUTERS OR THE INTERNET A LITTLE OR A LOT FOR VARIOUS ACTIVITIES, BY NUMBER OF CLASSROOM COMPUTERS: 1999



NOTE: Teachers who reported that computers were not available to them in the classroom were excluded from the analyses presented in this figure.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

TABLE 3.8.—PERCENT OF PUBLIC SCHOOL TEACHERS BY NUMBER OF COMPUTERS AVAILABLE IN CLASSROOM WHO REPORT ASSIGNMENT OF VARIOUS ACTIVITIES TO A SMALL, MODERATE, OR LARGE EXTENT, OR NOT AT ALL: 1999

Activities	Number of computers available in the classroom		
	One	2-5	More than 5
All public school teachers	**43**	**45**	**12**
Solve problems/analyze data			
Not at all	59	40	23
Small extent	20	26	29
Moderate extent	16	26	27
Large extent	5	9	21
Word processing/spreadsheets			
Not at all	45	33	14
Small extent	19	20	21
Moderate extent	21	24	23
Large extent	15	23	42
Drills/practice			
Not at all	61	37	21
Small extent	21	20	23
Moderate extent	14	26	26
Large extent	4	18	30

NOTE: Teachers who reported that computers were not available them in the classroom were excluded from the analyses presented in this table. Percents are computed down the column for each grouping, but may not sum to 100 because of rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

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Chapter 4

Frequency of Technology Use

Highlights

- In 1999, nearly all teachers used the computers and the Internet when available in their schools, and most reported that their students used computers and the Internet in the school as well. Teachers were generally more likely to use computers and the Internet when located in their classrooms than elsewhere in the school, while their students were more likely to use computers and the Internet outside the classroom than inside.

- Elementary teachers were more likely to report that their students used computers at school, and secondary teachers were more likely to report that their students used the Internet at school.

- Teachers with more computers or more computers connected to the Internet in their classrooms generally used these technologies more often than teachers with fewer computers or Internet connections (as did their students). Additionally, teachers with computer or Internet connections in their classrooms used these technologies *elsewhere* in the school more often than teachers without such equipment in their classrooms (as did their students).

- Teachers in schools with lower minority enrollments were generally more likely to report using e-mail than teachers in schools with the highest minority enrollments, and teachers in schools with lower minority enrollments and lower poverty concentrations were generally more likely than teachers in schools with the highest minority enrollments and the highest poverty concentrations to report that their students used the Internet.

- Teachers with fewer years of teaching experience were generally more likely than teachers with more experience to report using computers, the Internet, and e-mail at school to a large extent.

- In 1999, nearly all teachers with computers or the Internet available at home used these technologies. Teachers with fewer years of teaching experience generally used these technologies at home more frequently than their most experienced colleagues. Teachers who used computers for instruction and who assigned projects that required their students to use a computer were more likely than teachers who did not use these technologies for such purposes to use computers and the Internet at home to a large extent.

Frequency of Technology Use

CHAPTER 4

This chapter provides findings on the frequency with which public school teachers and students use technology at school and at home. The chapter is divided into three main sections. The first uses the Current Population Survey (CPS) data to provide background information regarding technology use in schools and classrooms. The second section uses Fast Response Survey System (FRSS) and CPS data to describe the frequency of teachers' and students' technology use in schools and classrooms. The final section uses FRSS, National Assessment of Educational Progress (NAEP), and CPS data to examine teachers' and students' technology use at home. Each section explores frequency of use by the location and availability of technology in schools and classrooms, as well as school and teacher characteristics.

Frequency of Technology Use in Schools and Classrooms: 1997 to 1998

Internet

According to CPS data on Internet use, this technology has been used somewhat infrequently by public and private school teachers in past years, but use of this technology is growing. For example, in public and private schools, the percent of elementary teachers who used the Internet at work rose from 23 to 33 percent between 1997 and 1998, and the percent of secondary teachers who used the Internet at work increased from 28 to 43 percent (figure 4.1).

Current Frequency of Technology Use in Schools and Classrooms

This section presents recent data on teacher and student use of computers, including e-mail, Internet, and other technologies, from the

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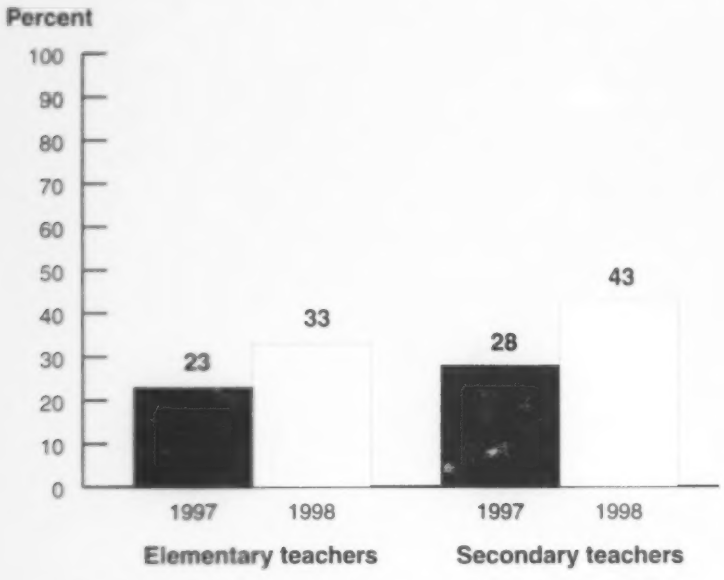
FIGURE 4.1.—PERCENT OF ELEMENTARY AND SECONDARY TEACHERS REPORTING USE OF THE INTERNET AT WORK: 1997 AND 1998



SOURCE: U.S. Census Bureau, Current Population Survey (CPS): October 1997 and December 1998.

1999 FRSS teacher survey of public school teachers' use of technology.

Frequency of Teachers' Technology Use at School

In the 1999 FRSS teacher survey, public school teachers were asked if computers, the Internet, and e-mail were available to them in various locations, and if available, the extent to which they used them ("not at all," "small extent," "moderate extent," or "large extent"). This section describes the frequency of teachers' use of these technologies by selected teacher and school characteristics and by the availability and location of technology in schools and classrooms.

Overall technology use. Among teachers who reported that computers were available in their schools, 99 percent indicated that they used computers either in their classrooms or elsewhere in the school (figure 4.2). Additionally, among teachers who indicated that computers with Internet connections were available in their schools, 96 percent used the Internet from their classrooms or elsewhere in their schools. Furthermore, at least three-fourths of teachers with e-mail availability used it at school.

Frequency of use by location of technology. The 1999 FRSS teacher survey asked teachers how frequently they used computers and the Internet in two locations: the classroom and elsewhere in the school (i.e., computer labs, libraries, or media centers).[1] Of the teachers who reported having computer availability in their classrooms (84 percent), nearly all of them (98 percent)

[1] These two categories were not mutually exclusive.

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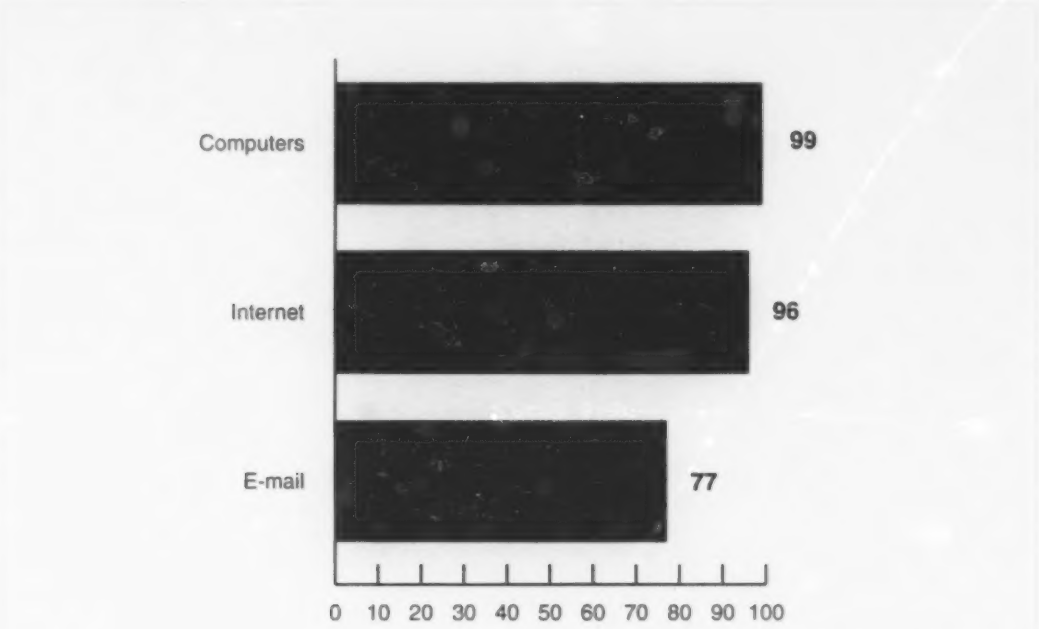
FIGURE 4.2.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING USE OF COMPUTERS, THE INTERNET, AND E-MAIL AT SCHOOL TO ANY EXTENT WHEN AVAILABLE: 1999



NOTE: Teachers who reported that computers, the Internet, and e-mail were not available to them anywhere in the school were excluded respectively from the "Computers," "Internet," and "E-mail" analyses presented in this figure. Detail may not sum to totals due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

reported using them at least to some extent (figure 4.3). Of the teachers who reported having computers available elsewhere in the school (95 percent), 85 percent reported using them. Teachers were significantly more likely to use computers in the classroom than elsewhere in the school, and they were also more likely to use them to a large extent in the classroom than elsewhere in the school (39 percent compared with 18 percent).

In addition, among teachers with Internet availability in their classrooms (64 percent), 88 percent reported using this technology. Of those teachers who reported Internet availability elsewhere in the school (90 percent), 70 percent indicated using it. Teachers were more likely to use the Internet in the classroom than elsewhere in the school, and they were also more likely to use it to a large extent in their classrooms than elsewhere in the school (20 percent compared with 10 percent). Furthermore, of the 74 percent of teachers reporting e-mail availability in the school, 77 percent used it at least to some extent.

Frequency of use by number of computers available. The 1999 FRSS teacher survey also asked teachers the number of computers and computers with Internet connections that were located in their classrooms. Overall, teachers with more computers in their classrooms used them more frequently than teachers with fewer computers in their classrooms. For example, 62 percent of public school teachers with more than five computers in their classrooms used them

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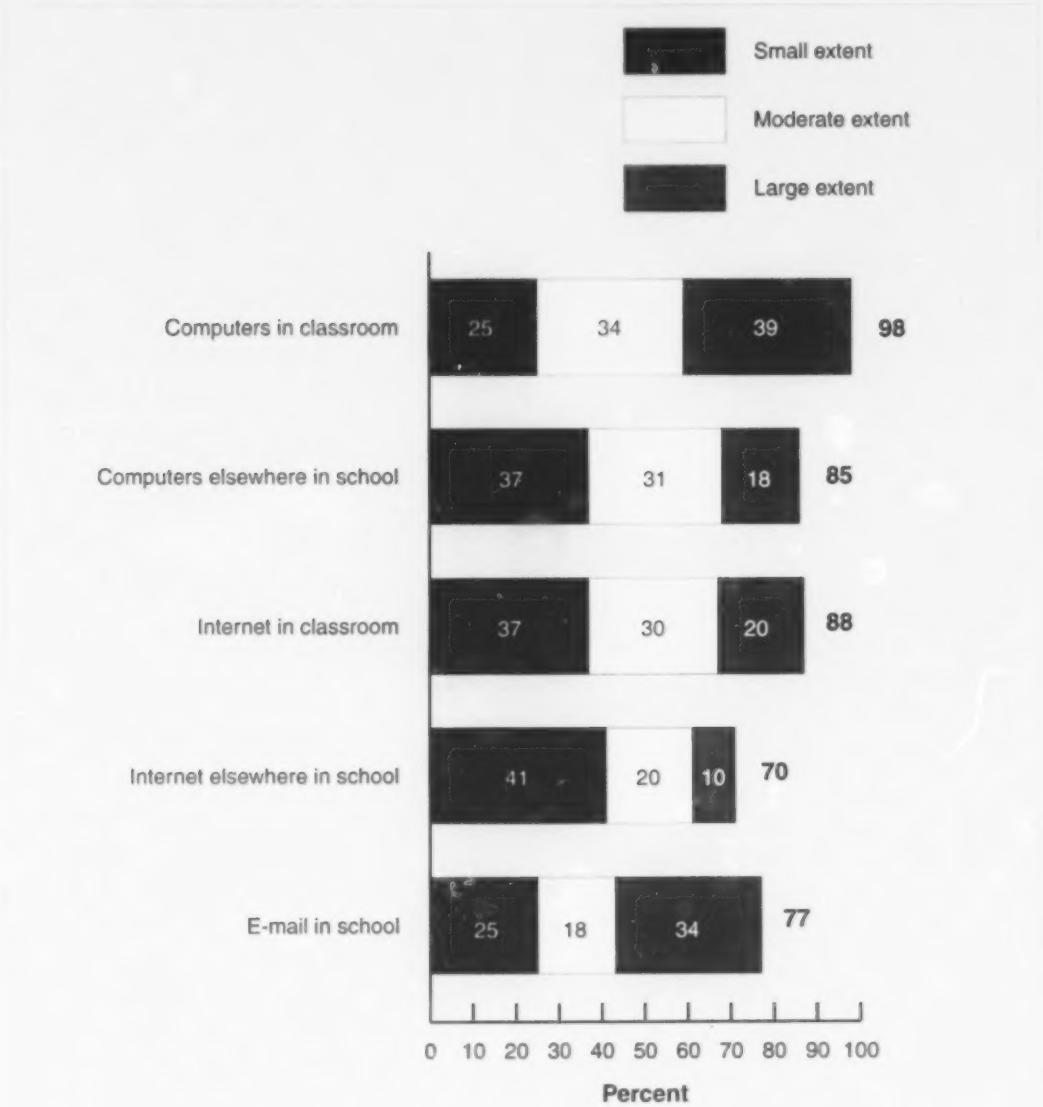
FIGURE 4.3.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING FREQUENCY OF USE OF VARIOUS TECHNOLOGIES TO A SMALL, MODERATE, OR LARGE EXTENT: 1999



NOTE: Teachers reporting not having the listed technologies available were excluded from their respective analyses presented in this figure. The listed technologies were available to the following percentages of public school teachers: Computers in classroom, 84 percent; Computers elsewhere in school, 95 percent; Internet in classroom, 64 percent; Internet elsewhere in school, 90 percent; E-mail in school, 74 percent. Detail may not sum to totals due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

to a large extent compared with 43 percent of teachers with two to five computers and 28 percent of teachers with one computer in their classrooms (figure 4.4). Similarly, teachers with more than five computers with Internet access in their classroom used the Internet from the classroom more frequently than teachers with fewer computers with Internet access in their

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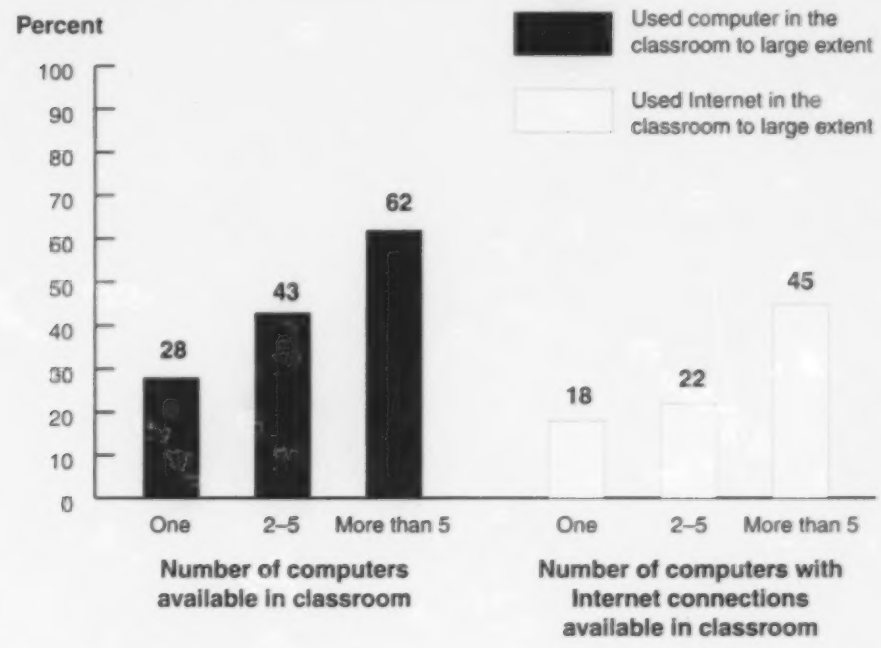
FIGURE 4.4.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING USE OF COMPUTERS OR THE INTERNET IN THE CLASSROOM TO A LARGE EXTENT, BY NUMBERS OF COMPUTERS AND COMPUTERS WITH INTERNET CONNECTIONS IN THE CLASSROOM: 1999



NOTE: Teachers who reported that computers were not available to them in the classroom were excluded from the "Number of computers available in the classroom" analyses presented in this figure. Teachers who reported that computers with Internet connections were not available to them in the classroom were excluded from the "Number of computers with Internet connections available in the classroom" analyses presented in this figure.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

classrooms. For example, 45 percent of teachers with more than five computers connected to the Internet used the Internet from the classroom to a large extent in their classrooms compared with 18 percent of teachers with one computer.

Furthermore, teachers with computers in their classrooms used computers *elsewhere in the school* more often than teachers with no classroom computers (figure 4.5). At least one-fifth of teachers with computers in their classrooms used computers elsewhere in the school to a large extent compared with 10 percent of teachers with no computers in their classrooms. Similarly, teachers with one or more than five computers connected to the Internet in their classrooms used the Internet *elsewhere* in the school more often than teachers without classroom computers with Internet connections. Twenty-four percent of teachers with more than five classroom computers connected to the Internet and 12 percent of teachers with one classroom computer connected to the Internet used the Internet elsewhere in the school to a large extent, compared with 7 percent of teachers with no classroom computers connected to the Internet.

Frequency of use by teacher and school characteristics. Differences were found in the frequency of teachers' use of computers, the Internet, and e-mail by school and teacher characteristics. Teachers

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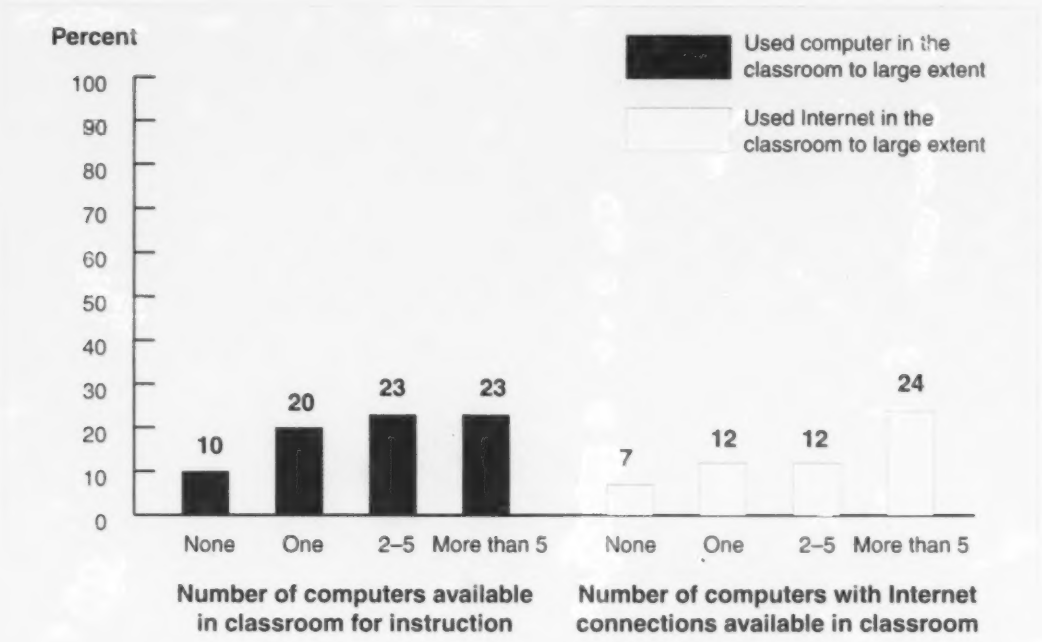
FIGURE 4.5.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING USE OF COMPUTERS OR THE INTERNET ELSEWHERE IN THE SCHOOL TO A LARGE EXTENT, BY NUMBERS OF COMPUTERS AND COMPUTERS WITH INTERNET CONNECTIONS IN THE CLASSROOM: 1999



NOTE: Teachers who reported that computers were not available to them in the classroom were excluded from the "Number of computers available in the classroom" analyses presented in this figure. Teachers who reported that computers with Internet connections were not available to them in the classroom were excluded from the "Number of computers with Internet connections available in the classroom" analyses presented in this figure.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

with fewer years of teaching experience were more likely to use computers, the Internet, and e-mail to a large extent at school than their more experienced colleagues. For example, 48 percent of teachers with 3 or fewer years of teaching experience and 45 percent of teachers with 4 to 9 years of experience used computers at school to a large extent, compared with 33 percent of teachers with 20 or more years experience (figure 4.6). The pattern is similar for Internet and e-mail use. Furthermore, teachers in schools with minority enrollments of 6 to 20 percent were more likely to use e-mail to a large extent than teachers in schools with the highest minority enrollments (42 percent compared with 25 percent—table 4.1).

Comparisons with other occupations. According to the 1997 CPS, 69 percent of adults employed as secondary teachers (either in public or private schools) and 67 percent employed as elementary teachers (either in public or private schools) reported using computers at work (figure 4.7). Both are significantly lower than such occupations as librarians, editors and reporters, and college faculty, and the percentage of elementary school teachers who reported using computers at work was lower than that of those employed as lawyers and judges and real estate and

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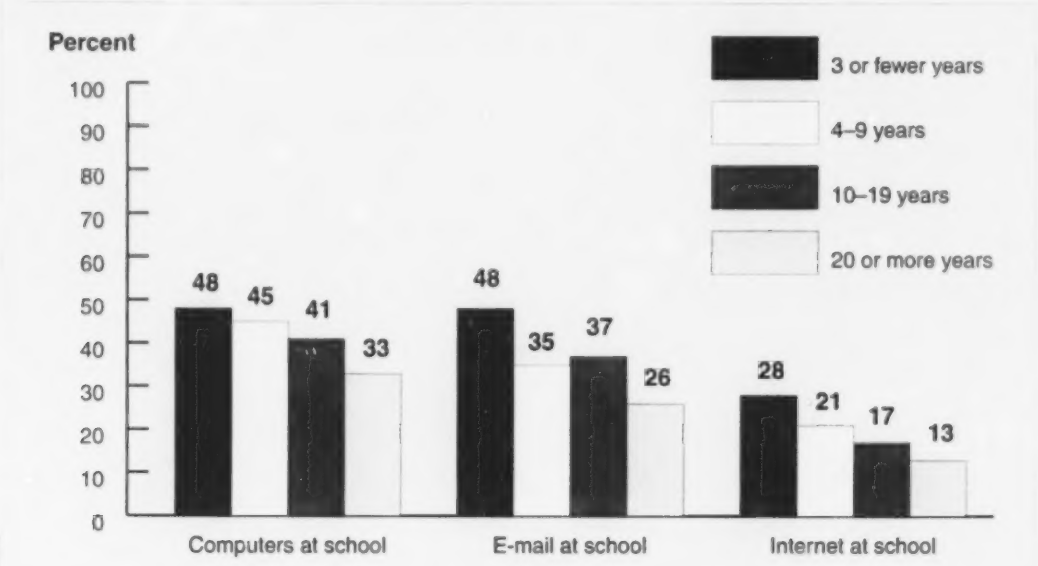
FIGURE 4.6.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING USE OF COMPUTERS, E-MAIL, AND THE INTERNET AT SCHOOL TO A LARGE EXTENT, BY YEARS OF TEACHING EXPERIENCE: 1999



NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the "Computers at school" analyses presented in this figure. Teachers who reported that e-mail was not available to them anywhere in the school were excluded from the "E-mail at school" analyses presented in this figure. Teachers who reported that the Internet was not available to them anywhere in the school were excluded from the "Internet at school" analyses presented in this figure.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

sales agents. However, the percentage for both elementary and secondary school teachers was higher than that of teachers' aides (40 percent). Forty-eight percent of U.S. adults employed in other occupations reported using computers at work.

Frequency of Students' Technology Use at School

In the 1999 FRSS teacher survey, public school teachers were asked how often students in one of their typical classes used computers and the Internet—"not at all," "rarely," "sometimes," or "often"—in various locations (i.e., in classrooms and elsewhere in the school). This section describes the frequency of students' use of computers and the Internet by the availability and location of technology in schools and classrooms and by selected teacher and school characteristics. Findings presented in this section are restricted to teachers who reported that these technologies were available in their schools.

[2] Estimates of the frequency of teachers' use of technology (figure 4.3) and students' use of technology (figure 4.8) are not comparable. Due to differences in the way the questions were asked for teachers' own use and their students' use, the sample filter representing availability is somewhat different for each group.

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TABLE 4.1.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING USING E-MAIL AT SCHOOL TO A LARGE EXTENT, BY SCHOOL CHARACTERISTICS: 1999

School characteristics	E-mail used
All public school teachers	**34**
Locale	
City	31
Urban fringe	36
Town	35
Rural	32
Percent minority enrollment in school	
Less than 6 percent	36
6 to 20 percent	42
21 to 49 percent	30
50 percent or more	25
Percent of students in school eligible for free or reduced-price school lunch	
Less than 11 percent	37
11 to 30 percent	41
31 to 49 percent	33
50 to 70 percent	26
71 percent or more	29

NOTE: Teachers who reported that e-mail was not available to them anywhere in the school were excluded from the analyses presented in this table.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

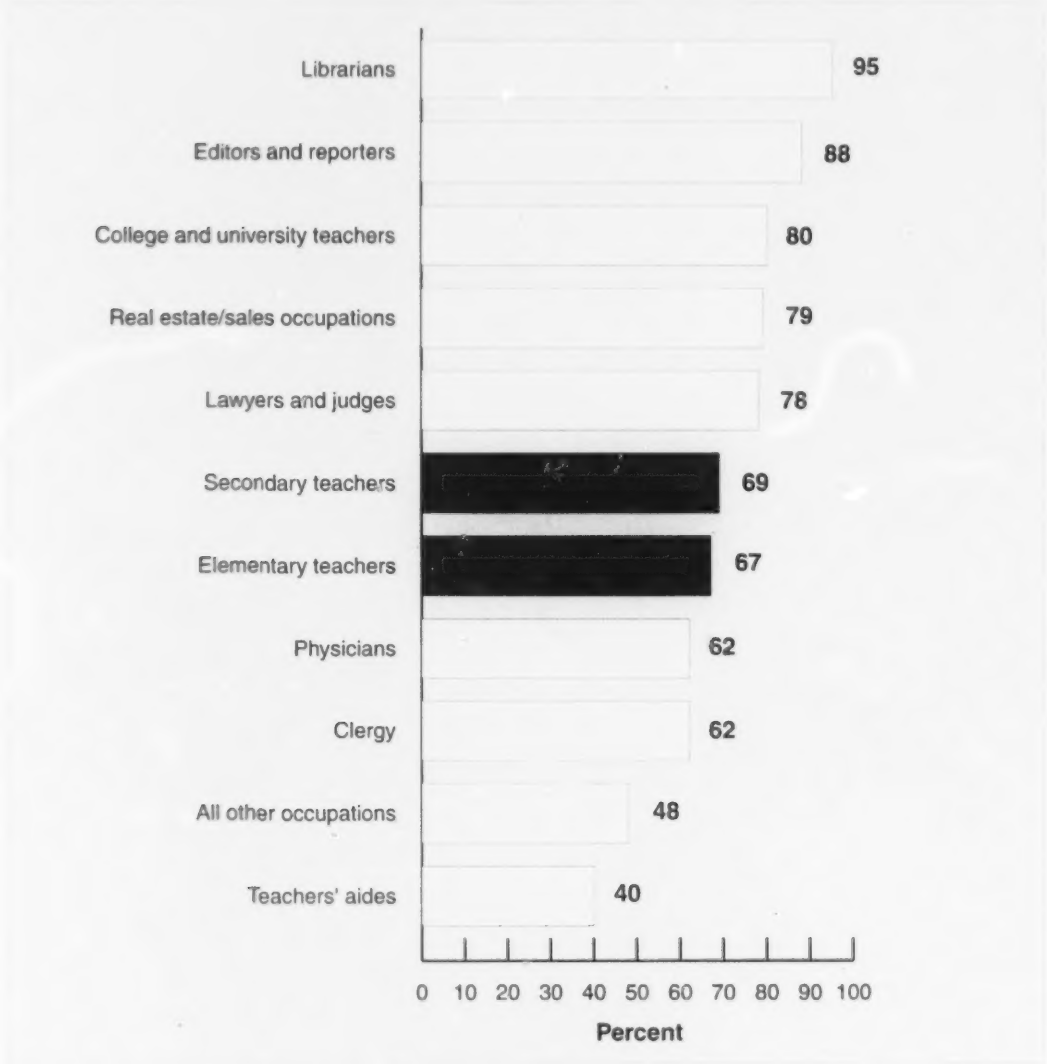
Overall technology use. Eighty-eight percent of teachers with computers available in their schools reported that their students used computers either in the classroom or in computer labs, libraries, and media centers in 1999 (table A-4.3). Furthermore, 61 percent of all teachers reported that students used the Internet in the classroom or somewhere else in the school in 1999 (table A-4.3).

Frequency of use by location of technology. Approximately seven out of ten teachers reported that students used classroom computers; however, a higher percentage of teachers (78 percent) reported that students used them elsewhere in the school (figure 4.8).[2] Thirty-four percent of teachers reported that students used the Internet in the classroom; however, a higher percentage of teachers (55 percent) reported that students used the Internet elsewhere in the school.

Twenty-six percent of teachers reported that students used classroom computers often, and 28 percent of teachers reported that students used computers elsewhere often. Six percent of teachers indicated that students used classroom computers with Internet access often, and 9

[2] Distance learning is defined as the transmission of information from one geographic location to another via various modes of telecommunications technology.

FIGURE 4.7.—PERCENT OF EMPLOYED ADULTS IN THE UNITED STATES REPORTING USE OF COMPUTERS AT WORK, BY VARIOUS OCCUPATIONS: 1997



NOTE: "All other occupations" refers to all full-time and part-time employed adults in occupations other than those listed in this figure.

SOURCE: U.S. Census Bureau, Current Population Survey (CPS), October 1997.

percent of teachers indicated that students used computers with Internet access elsewhere in the school often. Sixteen percent of teachers reported that students used other technologies, such as distance learning[3] through the Internet and other interactive media.

Frequency of use by number of computers available. Overall, teachers with more computers or Internet availability in their classrooms reported that they and their students used these technologies more frequently than teachers with fewer computers in their classrooms. For example, 61 percent of teachers with more than five computers in their classrooms reported that students used them often compared with 41 percent of teachers with two to five computers and

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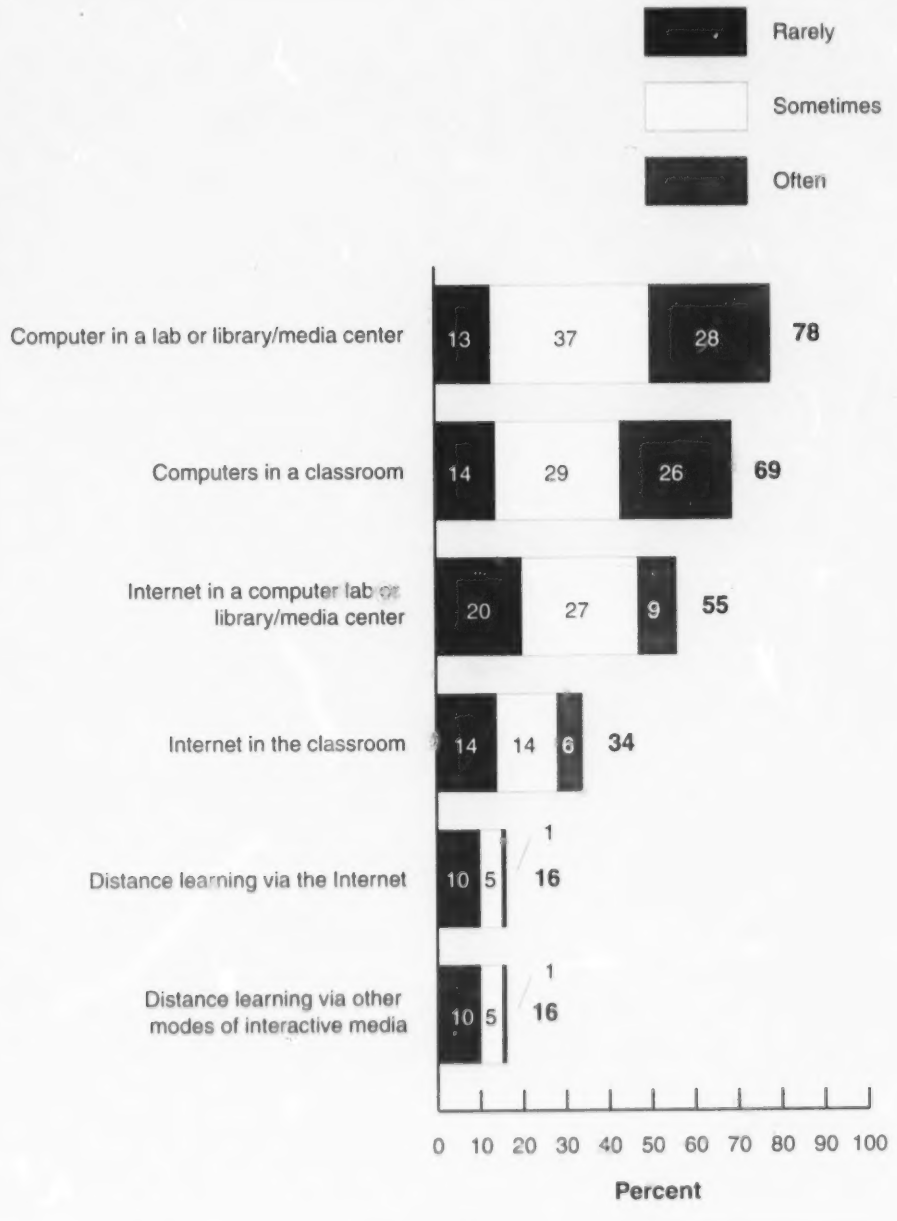
FIGURE 4.8.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING STUDENT USE OF VARIOUS TECHNOLOGIES IN SCHOOLS AND CLASSROOMS: 1999



NOTE: Teachers who reported that computers were not available to them in the classroom were excluded from the analyses presented in this figure. Detail may not sum to totals due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

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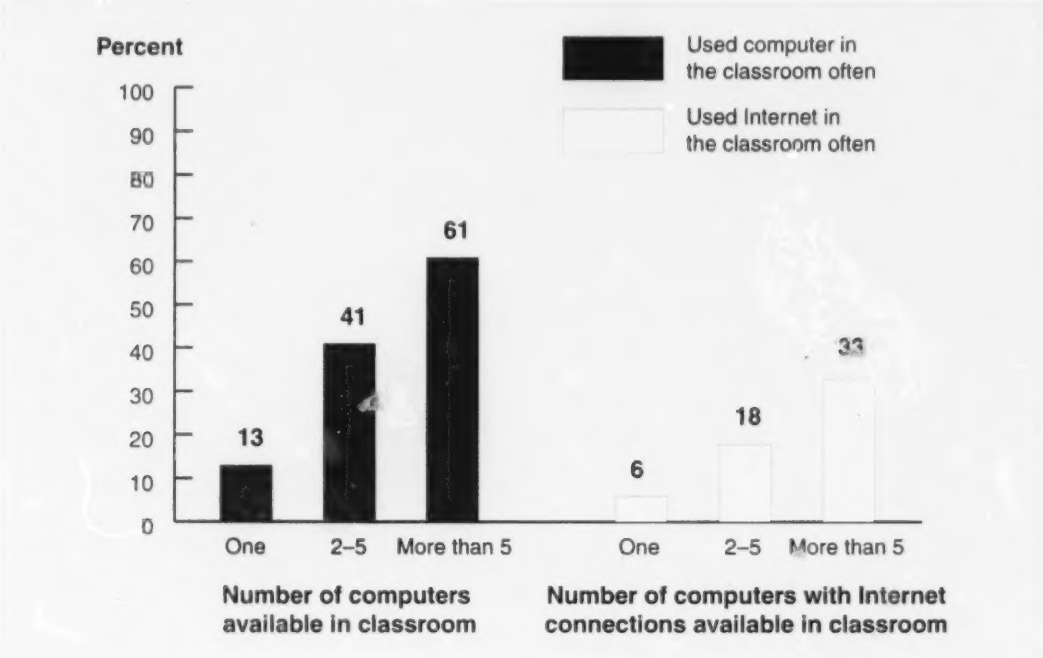
FIGURE 4.9.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING STUDENT USE OF COMPUTERS OR THE INTERNET IN THE CLASSROOM OFTEN, BY NUMBER OF COMPUTERS AND NUMBER OF COMPUTERS WITH INTERNET CONNECTIONS IN THE CLASSROOM: 1999



NOTE: Teachers who reported that computers were not available to them in the classroom were excluded from the analyses presented in this figure.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

13 percent of teachers with one computer in their classrooms (figure 4.9). Similarly, 33 percent of teachers with more than five classroom computers connected to the Internet reported that students used them often compared with 6 percent of teachers with one classroom computer connected to the Internet. Additionally, teachers with two to five classroom computers connected to the Internet were more likely than teachers with one such computer to report that students used the Internet often (18 percent compared with 6 percent).

Furthermore, teachers with computers in their classrooms reported that students used computers *elsewhere in the school* more often than teachers with no classroom computers (figure 4.10). At least one out of three teachers with computers in their classrooms reported that students used computers elsewhere in the school, compared with one out of six teachers without a classroom computer. Teachers with more than five computers connected to the Internet in their classrooms were two to five times as likely as teachers with one or no computers with Internet connections to report that students used the Internet *elsewhere* in the school (29 percent compared with 5 to 11 percent). Additionally, teachers with one (11 percent), two to five (12 percent), and more than five (29 percent) computers with Internet access in the classroom were more likely than teachers with no computers with Internet access in the classroom (5 percent) to report that their students used the Internet elsewhere in the school.

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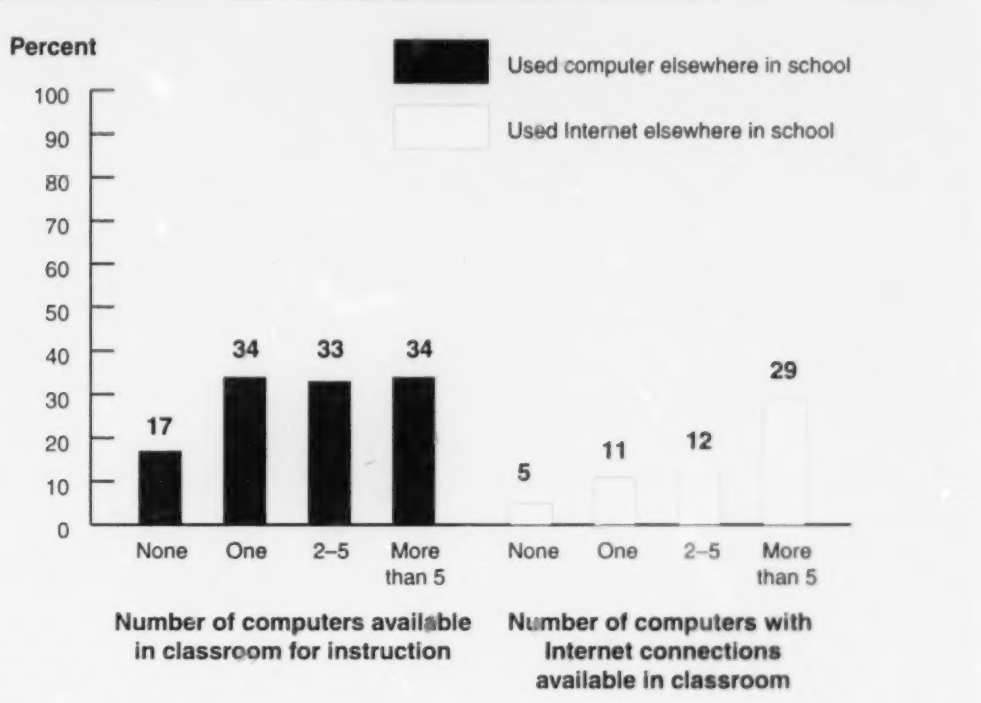
FIGURE 4.10.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING STUDENT USE OF COMPUTERS OR THE INTERNET ELSEWHERE IN THE SCHOOL OFTEN, BY NUMBER OF COMPUTERS FOR INSTRUCTION AND NUMBER OF COMPUTERS WITH INTERNET CONNECTIONS IN THE CLASSROOM: 1999



NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the analyses presented in this figure.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Frequency of use by teacher and school characteristics. Students' use of technology, as reported by their teachers, varied by teacher and school characteristics. For example, elementary teachers (92 percent) were more likely than secondary teachers (80 percent) to report that their students used computers at school to any extent (figure 4.11). However, secondary teachers (72 percent) were more likely than elementary teachers (56 percent) to report that their students used the Internet at school to any extent.

Furthermore, teachers in schools with lower minority enrollments were generally more likely than teachers in schools with the highest minority enrollments to report that students used the Internet at school. Sixty-four percent of teachers in schools with less than 6 percent minority enrollments and 65 percent of teachers in schools with 6 to 20 percent minority enrollments reported that students used the Internet in school compared with 53 percent of teachers in schools with more than 50 percent minority enrollments (table 4.2).

Similarly, teachers in schools with lower poverty concentrations were generally more likely to report that students used the Internet at school than teachers in the highest poverty schools.

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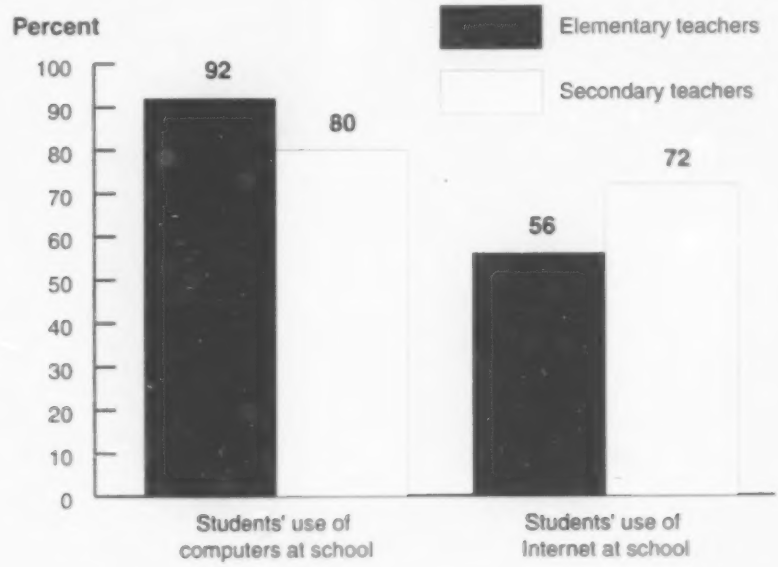
FIGURE 4.11.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING STUDENT USE OF COMPUTERS AND THE INTERNET AT SCHOOL TO ANY EXTENT, BY INSTRUCTIONAL LEVEL: 1999



NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the analyses presented in this figure.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Seventy-one percent of teachers in schools with less than 11 percent of students eligible for free or reduced-price lunch, 63 percent of teachers in schools with 11 to 30 percent of eligible students, and 66 percent of teachers in schools with 31 to 49 percent of students eligible for free or reduced-price lunch reported that students used the Internet at school compared with 50 percent of teachers in schools with 71 percent or more students eligible for free or reduced-price lunch.

Current Frequency of Technology Use at Home

Experience using a computer or the Internet may improve teachers' and students' technology skills and increase their level of comfort with technology, regardless of whether the use is at school or at home. In the 1999 FRSS teacher survey of technology use, teachers were asked if a computer, the Internet, or a school network through which they could access the Internet were available to them at home. If they were available, teachers were then asked about the extent to which they used them ("not at all," "small extent," "moderate extent," or "large extent"). Because the FRSS did not ask similar information about students, data from NAEP and CPS are used to describe students' technology use at home.

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public school teachers with computers at home used them, and about half of the teachers used them to a large extent (table A-4.3).

TABLE 4.2.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING STUDENT USE OF THE INTERNET IN THE CLASSROOM, COMPUTER LABS, MEDIA CENTERS, OR LIBRARIES TO ANY EXTENT DURING CLASS TIME, BY SCHOOL CHARACTERISTICS: 1999

School characteristics	Internet used
All public school teachers	**61**
Locale	
City	58
Urban fringe	60
Town	64
Rural	64
Percent minority enrollment in school	
Less than 6 percent	64
6 to 20 percent	65
21 to 49 percent	63
50 percent or more	53
Percent of students in school eligible for free or reduced-price school lunch	
Less than 11 percent	71
11 to 30 percent	63
31 to 49 percent	66
50 to 70 percent	56
71 percent or more	50

NOTE: Teachers who reported that the Internet was not available to them anywhere in the school were excluded from the analyses presented in this table.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Teacher Use of Computers and the Internet at Home

The 1997 CPS indicates that for public and private school teachers, 83 percent of elementary teachers and 89 percent of secondary teachers used home computers to any extent when they were available (figure 4.12).[4] This compares with 74 percent of adults in other occupations with computers at home who used them to any extent. Two years later, the 1999 FRSS teacher survey indicates that 98 percent of public school teachers with computers at home used them, and about half of the teachers used them to a large extent (table A-4.3).

Teachers' Internet use at home significantly increased between 1997 and 1998 for both elementary and secondary teachers. According to the 1997 CPS, 35 percent of all elementary teachers with computers in their households and 44 percent of all secondary teachers with computers in their households reported using the Internet at home (figure 4.12). In 1998, CPS data show that 57 percent of elementary teachers with computers in their households and 60

[4] Internet availability could not be ascertained from the CPS data.

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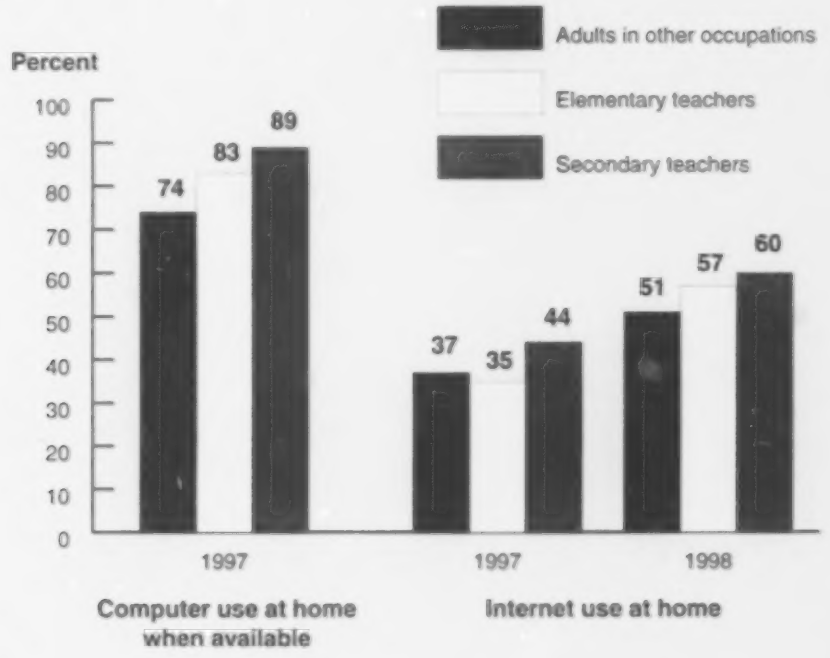
FIGURE 4.12.—PERCENT OF EMPLOYED U.S. ELEMENTARY TEACHERS, SECONDARY TEACHERS, AND ADULTS IN OTHER OCCUPATIONS REPORTING USE OF COMPUTERS AND THE INTERNET AT HOME TO ANY EXTENT WHEN COMPUTERS ARE AVAILABLE IN THE HOUSEHOLD: 1997 AND 1998



NOTE: Adults who reported that computers were not available to them at home were excluded from the analyses presented in this figure. Availability of the Internet at home could not be determined.

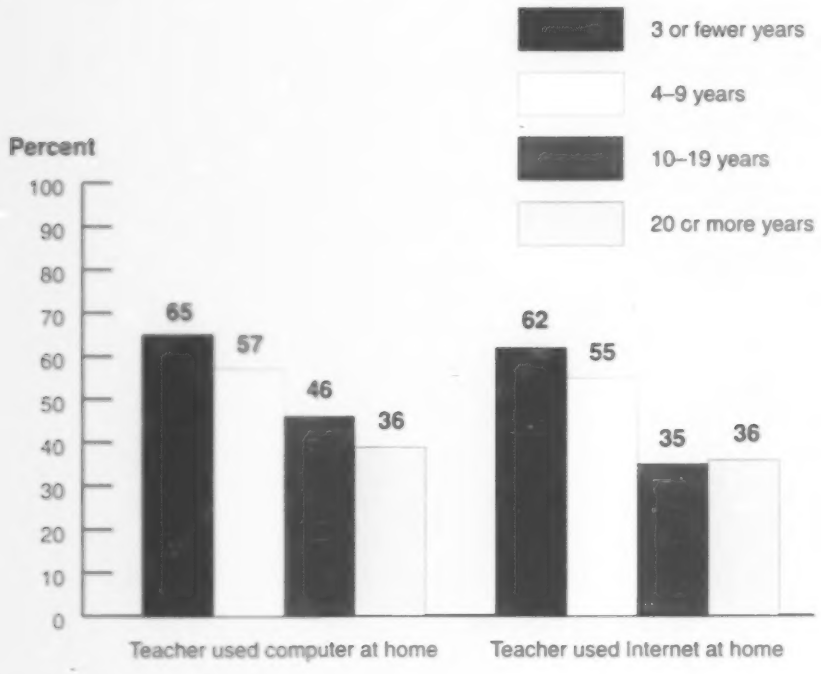
SOURCE: U.S. Census Bureau, Current Population Survey (CPS): October 1997 and December 1998.

percent of secondary teachers with computers in their households reported using the Internet at home. Home Internet use also increased between 1997 and 1998 for adults in other occupations with computers in their households, from 37 to 51 percent.

The 1999 FRSS teacher survey indicates that nearly all (97 percent) public school teachers with the Internet available at home used it, and about two-fifths (43 percent) of teachers with home Internet access reported using it to a large extent. The 1999 FRSS teacher survey also inquired about school networks that teachers can access at home. Fifty-six percent of teachers used this technology when it was available (table A-4.3).

Home use by teacher and school characteristics. Public school teachers' use of computers and the Internet at home varied by their years of teaching experience. For example, teachers with 3 or fewer years and those with 4 to 9 years of teaching experience were more likely to use their home computers to a large extent than teachers with 20 or more years of teaching experience (65 percent and 57 percent, compared with 39 percent—figure 4.13). Similarly, teachers with 3 or fewer years and those with 4 to 9 years of teaching experience were more likely to use the

FIGURE 4.13.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING USE OF COMPUTERS AND THE INTERNET AT HOME TO A LARGE EXTENT, BY YEARS OF TEACHING EXPERIENCE: 1999



NOTE: Teachers who reported that computers were not available to them at home were excluded from the "Teacher used computer at home" analyses presented in this figure. Teachers who reported that the Internet was not available to them at home were excluded from the "Teacher used Internet at home" analyses presented in this figure.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Internet at home to a large extent than teachers with 10 to 19 years and those with 20 or more years of teaching experience (62 percent and 55 percent compared with 35 percent and 36 percent).

Frequency of Technology Use at Home and Technology Use for Instruction

Public school teachers who used computers for instruction during class and teachers who assigned projects that required their students to use a computer were more likely to use computers and the Internet at home to a large extent than teachers who did not use these technologies for such purposes. For example, 54 percent of teachers who used computers for instruction also used home computers to a large extent, compared with 43 percent of teachers who did not use computers for instruction (figure 4.14). Likewise, 52 percent of teachers who assigned projects requiring students to use computers also used home computers to a large extent, compared with 37 percent of teachers who did not assign such projects. The pattern is similar for Internet use at home.

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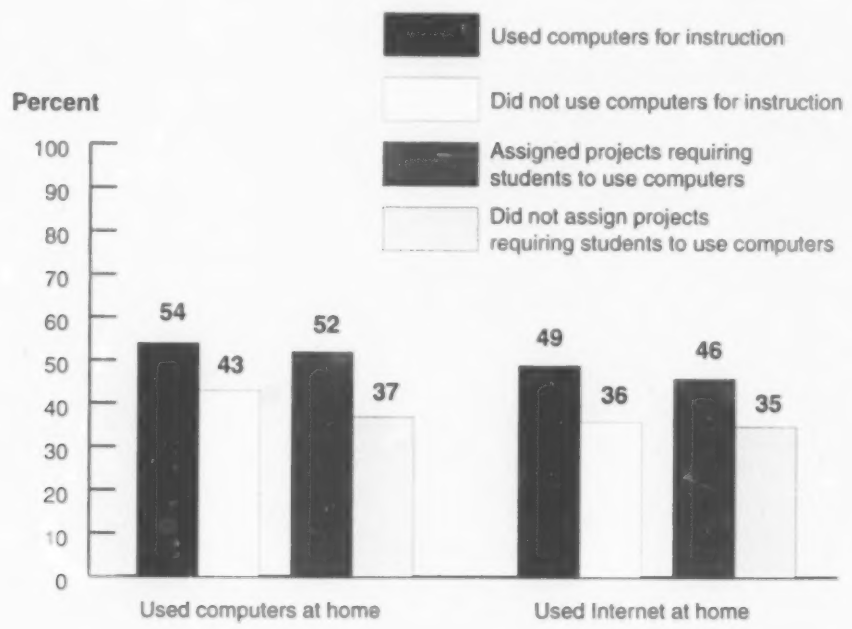
FIGURE 4.14.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING TECHNOLOGY USE IN SCHOOL TO A LARGE EXTENT FOR INSTRUCTION AND STUDENT ASSIGNMENT, BY THEIR USE OF COMPUTERS AND THE INTERNET AT HOME: 1999



NOTE: Teachers who reported that computers were not available to them at home were excluded from the "Used computers at home to a large extent" analyses presented in this figure. Teachers who reported that the Internet was not available to them at home were excluded from the "Used Internet at home to a large extent" analyses presented in this figure.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Student Access to Computers and the Internet at Home

NAEP data indicate that the use of home computers by public school students increased from 1992 to 1998 for fourth-graders, eighth-graders, and twelfth-graders. For example, fourth-graders, eighth-graders, and twelfth-graders who reported never or hardly ever using a computer at home declined between 1992 and 1998 (68 percent to 55 percent, 60 percent to 34 percent, and 50 percent to 23 percent, respectively—figure 4.15).

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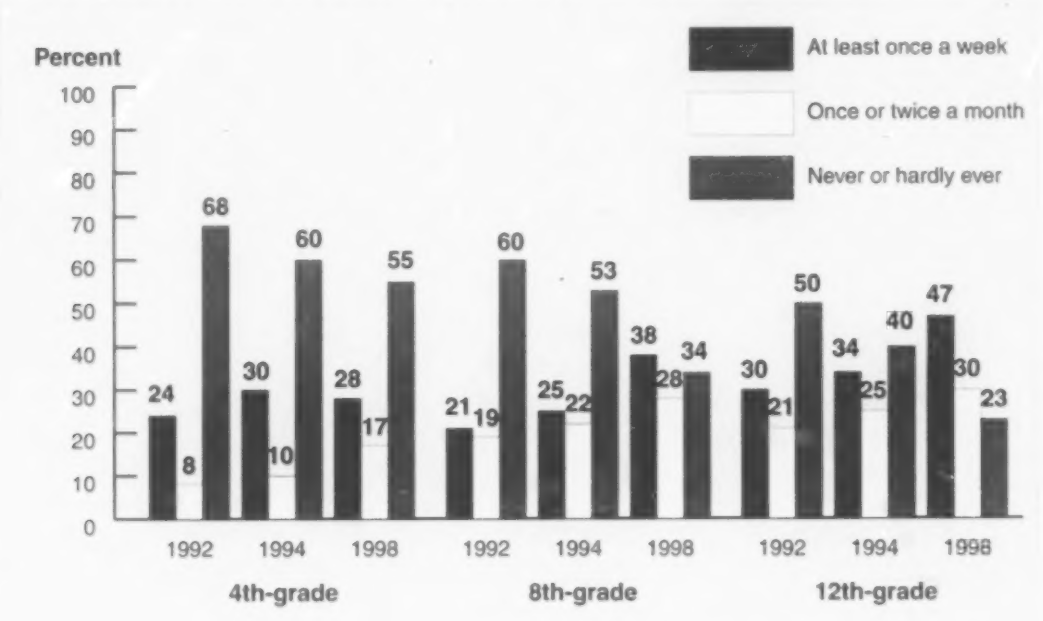
FIGURE 4.15.—PERCENT OF PUBLIC SCHOOL 4TH-, 8TH-, AND 12TH-GRADE STUDENTS REPORTING USING A COMPUTER AT HOME AT LEAST ONCE A WEEK, ONCE OR TWICE A MONTH, OR NEVER OR HARDLY EVER: 1992, 1994, AND 1998



NOTE: Percents may not sum to 100 due to rounding.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1992, 1994, and 1998 Reading Assessments.

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Chapter 5

Teacher Preparation and Training

Highlights

- In 1999, one-third of teachers reported feeling very well or well prepared to use computers and the Internet for instruction, with less experienced teachers indicating they felt more prepared to use technology than their more experienced colleagues. For many instructional activities, teachers who reported feeling well prepared or very well prepared to use technology were more likely to use it or assign students to use it than teachers who reported feeling unprepared.

- Teachers cited independent learning most frequently as preparing them for technology use, followed by professional development activities and their colleagues. Whereas half of all teachers reported that college and graduate work prepared them to use technology, less experienced teachers were generally much more likely than their more experienced colleagues to indicate that this education prepared them to use computers and the Internet.

- Most teachers indicated that professional development activities on a number of topics were available to them, including training on software applications, the use of the Internet, and the use of computers and basic computer training. Participation was relatively high in these three activities (ranging from 75 to 83 percent), with more experienced teachers often more likely to participate than less experienced teachers. Teachers indicated that follow-up and advanced training were available less frequently, and approximately half of the teachers reporting that each of these two activities were available to them participated in them.

- Over a 3-year time period, most teachers participated in professional development activities that lasted the equivalent of 4 days or less (i.e., 32 or fewer hours). Teachers who reported spending more time in professional development activities (9 hours or more) were generally more likely than teachers who spent less time in such activities (fewer than 9 hours) to report feeling well or very well prepared to use computers and the Internet for instruction.

CHAPTER 5

Teacher Preparation and Training

The 1999 Fast Response Survey System (FRSS) teacher survey of technology use asked public school teachers a number of questions regarding their preparation and training on the following topics: their feelings of preparedness, the extent to which various training sources contributed to their understanding of technology (e.g., colleagues, independent learning), their participation in a number of different types of professional development activities and the length of their participation, and the supports they received for participating in training activities.

Teachers' Feelings of Preparedness

In 1999, 10 percent of teachers reported feeling "very well prepared," and 23 percent reported feeling "well prepared" to use computers and the Internet for classroom instruction. At least half of teachers reported feeling "somewhat prepared" to use these technologies for instruction (53 percent), and 13 percent reported feeling "not at all prepared" to use these technologies for instruction (table A-5.5).

Teachers' feelings of preparation varied by their years of teaching experience. For example, teachers with 3 or fewer years of teaching experience were generally more likely to report that they felt well prepared or very well prepared, compared with teachers with more years of teaching experience (45 percent compared with 31 percent of teachers with 10 to 19 years and 27 percent of teachers with 20 or more years of teaching experience—figure 5.1).

Preparedness and Teachers' Use of Technology

For many instructional activities, teachers who reported feeling better prepared to use technology were more likely to use it than teachers who indicated that they felt unprepared. Specifically, teachers who reported feeling well prepared or very well prepared were more likely than teachers who reported feeling unprepared to create instructional materials

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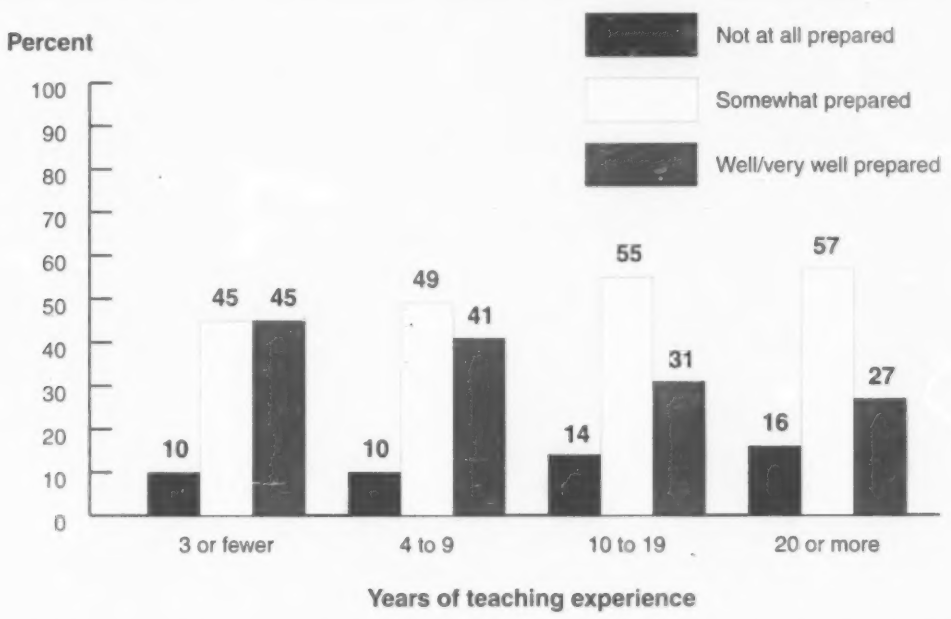
FIGURE 5.1.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING FEELING NOT AT ALL, SOMEWHAT, OR WELL/VERY WELL PREPARED TO USE COMPUTERS AND THE INTERNET FOR CLASSROOM INSTRUCTION, BY YEARS OF TEACHING EXPERIENCE: 1999



SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

(88 percent compared with 50 percent), gather information for planning lessons (71 percent compared with 28 percent), access model lesson plans (47 percent compared with 12 percent), access research and best practices for teaching (52 percent compared with 11 percent), create multimedia presentations for the classroom (55 percent compared with 12 percent), and perform administrative record keeping (62 percent compared with 34 percent). They were also more likely to communicate via e-mail with colleagues, students' parents, and students outside the classroom, as well as post homework or project information (table 5.1).

Teachers' use of technology for classroom assignments is also related to their feelings of preparedness. For each classroom instructional activity, teachers who reported feeling well prepared or very well prepared were more likely than teachers who reported feeling unprepared to report assigning students to use these technologies. For example, 66 percent of teachers who reported feeling well prepared or very well prepared to use technology indicated that they assigned students to use computers or the Internet to solve problems or analyze data, compared with 47 percent of teachers who reported feeling somewhat prepared and 14 percent of teachers who reported feeling unprepared (table 5.2).

Teacher Preparation and Training

Because teachers' use of technology is related to their feelings of preparedness, it is important to understand teachers' training for technology use and how that relates to their feelings of prepared-

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TABLE 5.1.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING USING COMPUTERS OR THE INTERNET FOR VARIOUS ACTIVITIES AT SCHOOL TO ANY EXTENT, BY EXTENT TO WHICH THEY FELT PREPARED TO USE COMPUTERS AND THE INTERNET FOR INSTRUCTION: 1999

	Activities				
Teachers' feelings of preparedness	Create instructional materials	Gather information for lesson plans	Access model lesson plans	Access research and best practice examples	Multimedia presentations
All public school teachers	**78**	**59**	**34**	**37**	**36**
Not at all	50	28	12	11	12
Somewhat	80	59	31	34	30
Well/very well	88	71	47	52	55

See note at end of table.

TABLE 5.1.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING USING COMPUTERS OR THE INTERNET FOR VARIOUS ACTIVITIES AT SCHOOL TO ANY EXTENT, BY EXTENT TO WHICH THEY FELT PREPARED TO USE COMPUTERS AND THE INTERNET FOR INSTRUCTION: 1999—CONTINUED

	Activities				
Teachers' feelings of preparedness	Administrative record keeping	Communicate with colleagues	Communicate with parents	Communicate with students	Post homework/ assignments
All public school teachers	**51**	**50**	**25**	**12**	**17**
Not at all	34	28	9	4	9
Somewhat	48	48	24	10	17
Well/very well	62	63	32	17	20

NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the analyses presented in this table.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

ness. This section examines a number of different types of information about teachers' training and preparation, including their sources of training, the availability of professional development in their schools and their participation in these activities, and the support and guidance they receive to facilitate their training.

Sources of Training

The 1999 teacher survey on technology use asked teachers to report the extent to which a number of sources prepared them to use computers and the Internet, including college and graduate work, professional development, colleagues, students, and independent learning. The

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TABLE 5.2.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING ASSIGNING STUDENTS VARIOUS ACTIVITIES TO ANY EXTENT THAT USE COMPUTERS OR THE INTERNET, BY EXTENT TO WHICH THEY FELT PREPARED TO USE COMPUTERS AND THE INTERNET FOR INSTRUCTION: 1999

	Activities			
Teachers' feelings of preparedness	Practice drills	Solve problems/ analyze data	Word processing/ spreadsheets	Graphical presentations
All public school teachers	**50**	**50**	**61**	**43**
Not at all	20	14	27	19
Somewhat	49	47	56	37
Well/very well	63	66	80	63

TABLE 5.2.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING ASSIGNING STUDENTS VARIOUS ACTIVITIES TO ANY EXTENT THAT USE COMPUTERS OR THE INTERNET, BY EXTENT TO WHICH THEY FELT PREPARED TO USE COMPUTERS AND THE INTERNET FOR INSTRUCTION: 1999—CONTINUED

	Activities			
Teachers' feelings of preparedness	Demonstrations/ simulations	Multimedia projects	CD-ROM research	Internet research
All public school teachers	**39**	**45**	**48**	**51**
Not at all	14	23	19	23
Somewhat	32	38	44	46
Well/very well	59	63	66	68

NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the analyses presented in this table.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers' Use of Computers and the Internet," FRSS 70, 1999.

most frequently cited sources of preparation were independent learning (93 percent of teachers indicated that independent learning prepared them to any extent), professional development activities (88 percent), and colleagues (87 percent—figure 5.2). Furthermore, approximately half of all public school teachers reported that students and college/graduate work prepared them to use computers or the Internet to any extent (54 percent and 51 percent, respectively).

Teachers with fewer years of teaching experience were generally more likely than their more experienced colleagues to indicate that college/graduate work prepared them to use computers and the Internet to any extent. Eighty-four percent of teachers with 3 or fewer years and 76 percent of teachers with 4 to 9 years of teaching experience reported that college/graduate work prepared them to use these technologies to any extent, compared with 44 percent of teachers with 10 to 19 years and 31 percent of teachers with 20 or more years of teaching experience (figure 5.3).

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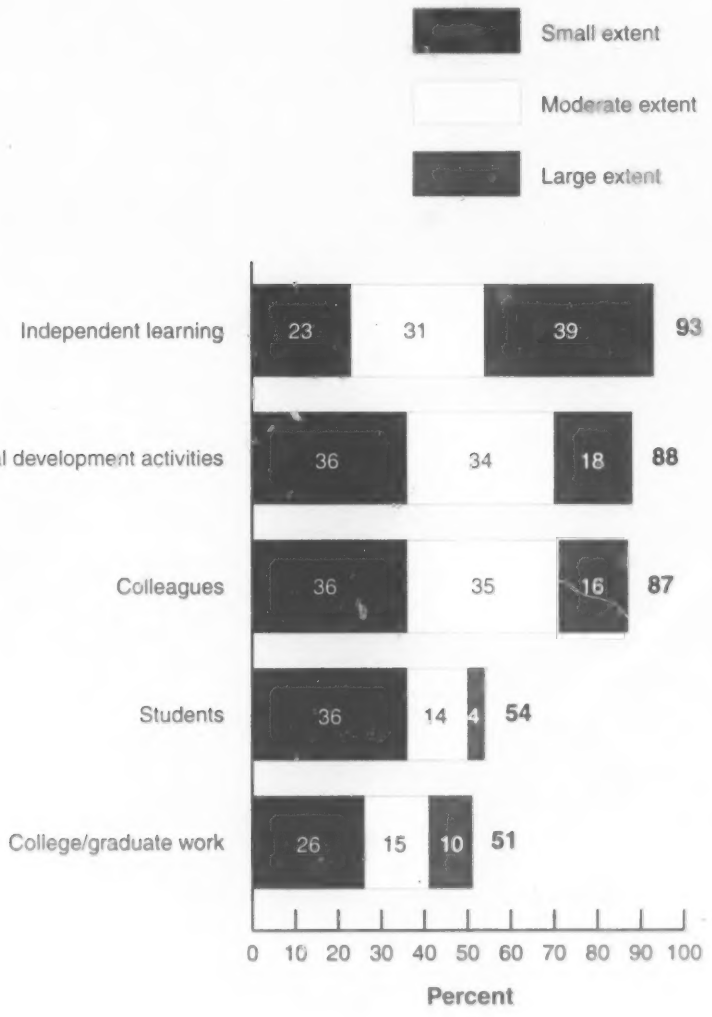
FIGURE 5.2.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING FEELING PREPARED TO USE COMPUTERS AND THE INTERNET TO A SMALL, MODERATE, OR LARGE EXTENT, BY VARIOUS SOURCES OF TRAINING: 1999



NOTE: Detail may not sum to totals due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Professional Development

The 1999 teacher survey of technology use asked a number of questions about professional development availability and participation. Specifically, the survey asked teachers if the following types of professional development activities were available to them and if they participated in these activities: use of computers and basic computer training, software applications, use of the Internet, integration of technology into the curriculum and classroom instruction, follow-up and/or advanced training, and use of other advanced telecommunications.

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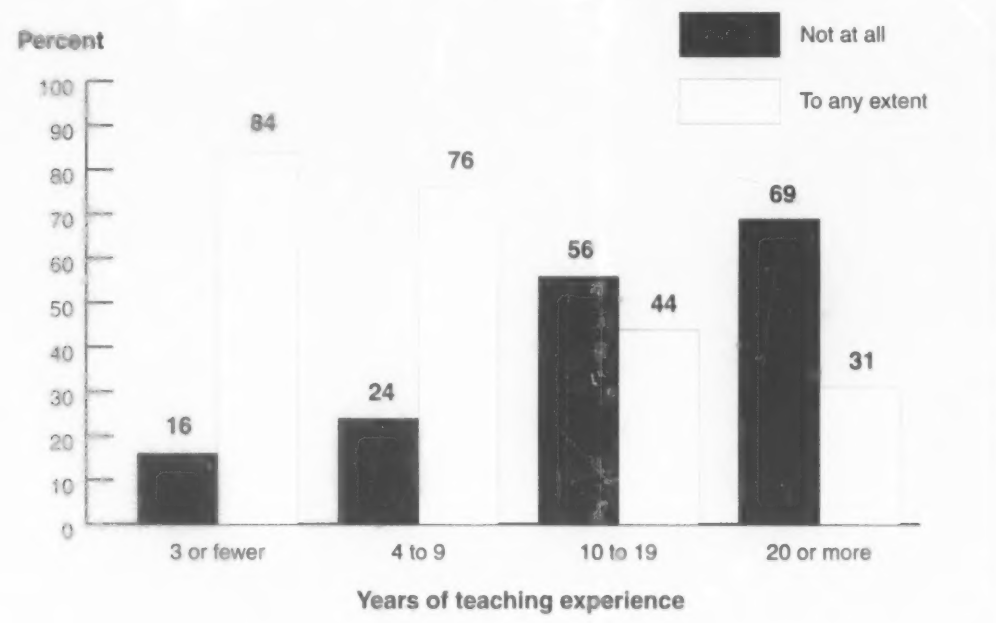
FIGURE 5.3.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING WHETHER COLLEGE/GRADUATE WORK PREPARED THEM NOT AT ALL OR TO ANY EXTENT TO USE COMPUTERS AND THE INTERNET, BY YEARS OF TEACHING EXPERIENCE: 1999



SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Availability. Teachers reported that professional development training on the use of computers and basic computer training was the type most likely to be available to them (96 percent), followed by software applications (88 percent), use of the Internet (87 percent), and integration of technology into the curriculum and classroom instruction (79 percent—figure 5.4). Teachers were least likely to report that follow-up and/or advanced training and use of other advanced telecommunications were available to them (67 percent and 54 percent, respectively).

Ninety-one percent of teachers in schools with 6 to 20 percent minority enrollments and 90 percent of teachers in schools with 21 to 49 percent minority enrollments reported that such training was available to them, compared with 81 percent of teachers in schools with 50 percent or more minority enrollments (figure 5.5). Furthermore, 94 percent of teachers in schools with less than 11 percent of the students eligible for free or reduced-price school lunch, 90 percent of teachers in schools with 11 to 30 percent of students eligible, and 91 percent of teachers in schools with 31 to 49 percent of students eligible for free or reduced-price school lunch reported that training in the use of the Internet was available to them, compared with 80 percent of teachers in schools with 50 to 70 percent of students eligible and 79 percent of teachers in schools with more than 70 percent of students eligible for free or reduced-price school lunch.

Participation. Among teachers who reported the availability of each professional development activity, participation during the last 3 years was highest in the use of computers and basic

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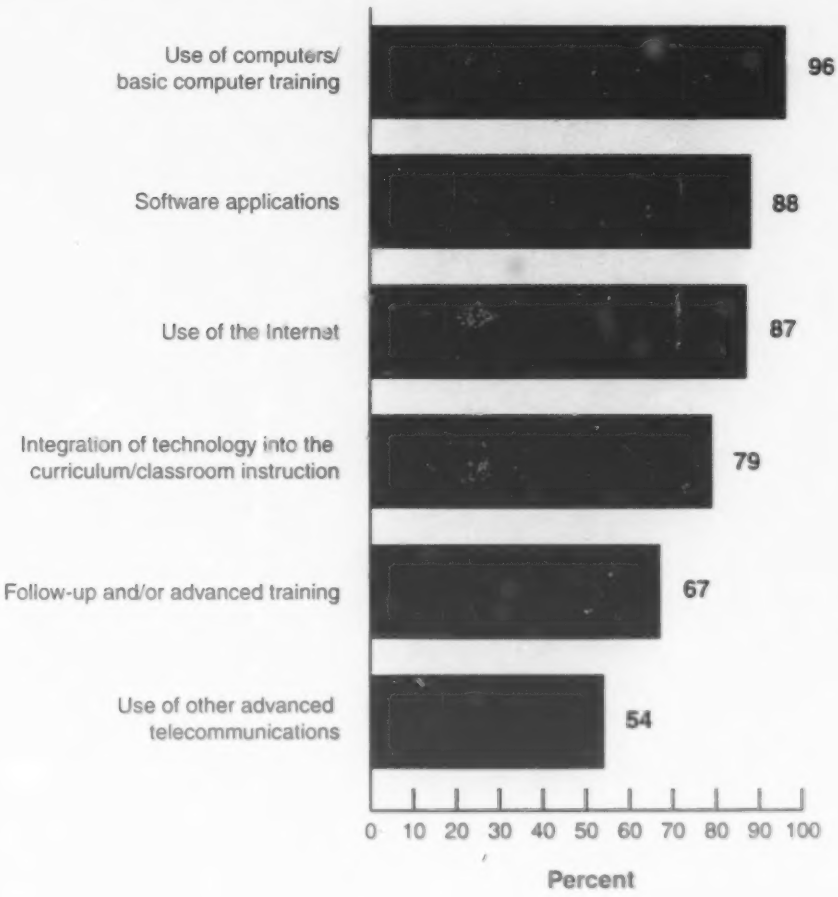
FIGURE 5.4.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING THE AVAILABILITY OF PROFESSIONAL DEVELOPMENT TRAINING ACTIVITIES FOR VARIOUS USES AND APPLICATIONS OF TECHNOLOGY: 1999



SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

computer training (83 percent) and software applications (81 percent), followed by use of the Internet (75 percent) and integration of technology into the curriculum and classroom instruction (74 percent—figure 5.6). Approximately half of the teachers who reported that follow-up and/or advanced training or the use of other advanced telecommunications were available to them participated in these activities (55 percent and 53 percent, respectively).

In general, teachers with more years of teaching experience were more likely to report having participated in basic computer use and software applications professional development activities than their less experienced colleagues. For example, 87 percent of teachers with 10 to 19 years of teaching experience and 90 percent of teachers with 20 or more years of teaching experience participated in computer use and basic computer training activities, compared with 63 percent of teachers with 3 or fewer years and 77 percent of teachers with 4 to 9 years of teaching experience (table 5.3).

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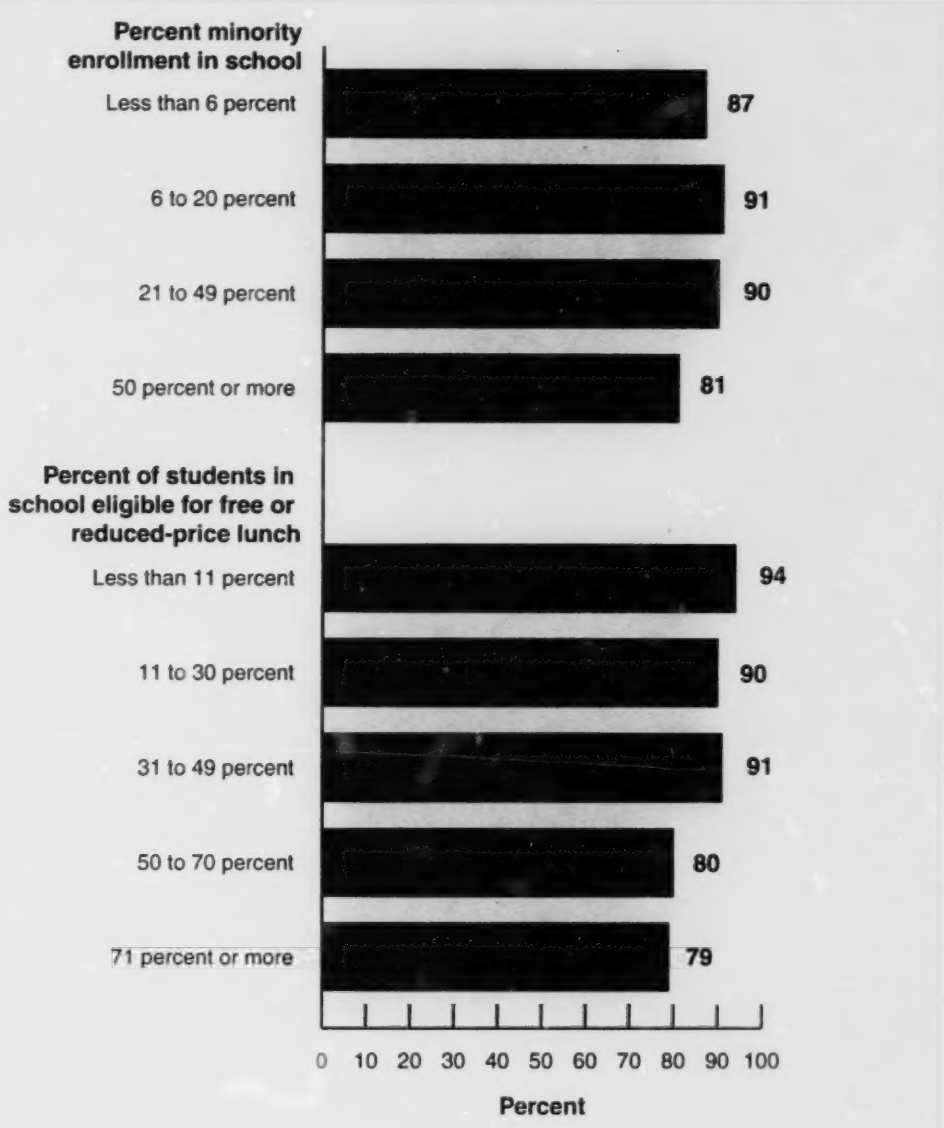
FIGURE 5.5.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING THE AVAILABILITY OF TRAINING IN THE USE OF THE INTERNET, BY PERCENT MINORITY ENROLLMENT IN SCHOOL AND PERCENT OF STUDENTS IN SCHOOL ELIGIBLE FOR FREE OR REDUCED-PRICE SCHOOL LUNCH: 1999



SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Time spent in professional development activities. The 1999 teacher survey of technology use also asked teachers the number of hours they participated in professional development activities in the use of computers or the Internet during the last 3 years. Forty-three percent of teachers participated in such professional development activities for 1 to 8 hours, 34 percent participated for 9 to 32 hours, and 12 percent participated in such activities for more than 32 hours

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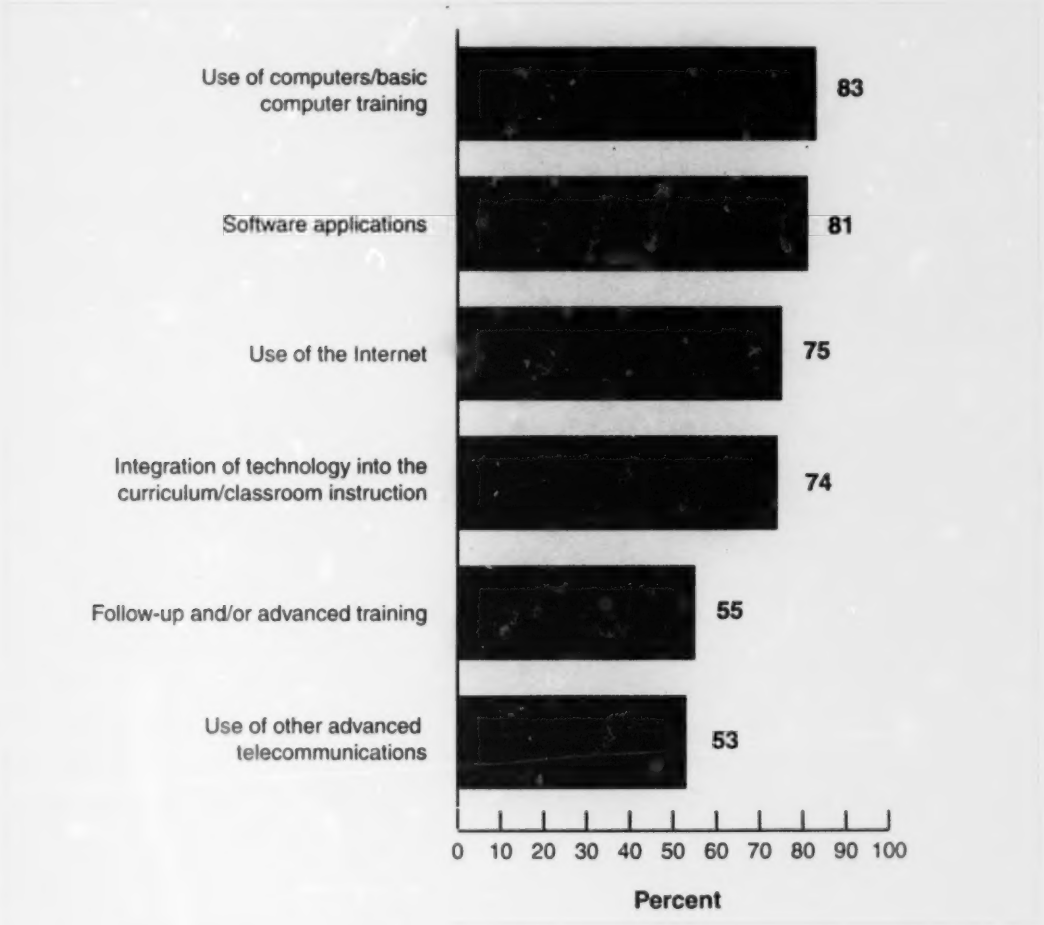
FIGURE 5.6.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING PARTICIPATING IN VARIOUS TYPES OF TRAINING, WHEN AVAILABLE: 1999



NOTE: Teachers reporting not having the listed types of training available were excluded from their respective analyses presented in this figure. The listed types of training were available to the following percentages of public school teachers: Use of computers/basic computer training, 96 percent; Software applications, 88 percent; Use of the Internet, 87 percent; Integration of technology into curriculum/classroom instruction, 79 percent; Follow-up and/or advanced training, 67 percent; Use of other advanced telecommunications, 54 percent.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

(figure 5.7). One in ten teachers indicated that they did not participate in any such professional development activities.

Preparedness and time spent in professional development activities. Teachers who spent more time in professional development activities were generally more likely than teachers who spent less time in such activities to indicate they felt prepared to use computers and the Internet for instruction. Specifically, teachers who reported spending more than a day (9 hours or more) in professional development were more likely to report feeling well prepared or very well prepared

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TABLE 5.3.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING PARTICIPATION IN AVAILABLE TRAINING PROGRAMS, BY YEARS OF TEACHING EXPERIENCE: 1999

Training programs	Years of teaching experience			
	3 or fewer	4-9	10-19	20 or more
Computer use/basic computer training	63	77	87	90
Software applications	64	78	85	84
Use of the Internet	65	74	75	78
Use of other advanced telecommunications (e.g., interactive audio, video, closed-circuit TV)	44	56	56	52
Integration of technology into the curriculum/ classroom instruction	66	74	77	75
Follow-up and/or advanced training	46	61	58	53

NOTE: Teachers reporting not having the above listed training programs available were excluded from the analyses presented in this table.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

to use computers or the Internet than those who reported spending a day or less (fewer than 9 hours) in such activities (table 5.4).

Support and Guidance for Participation in Technology Training

In addition to asking teachers about their training and preparation in the use of technology, the 1999 teacher survey of technology use also asked teachers if the following types of incentives were available to them for participation in professional development: course credit toward certification, additional resources for the teacher or classroom, paid expenses, release time, stipends, or connection to the Internet from home.

Approximately half of all teachers reported that course credit toward certification and additional resources were offered as incentives to participate in technology training (56 percent and 46 percent, respectively—figure 5.8). About two-fifths of teachers reported having paid expenses (40 percent) and release time and stipends (39 percent) as incentives. In addition, about one in five teachers reported that connections to the Internet from home were offered (22 percent).

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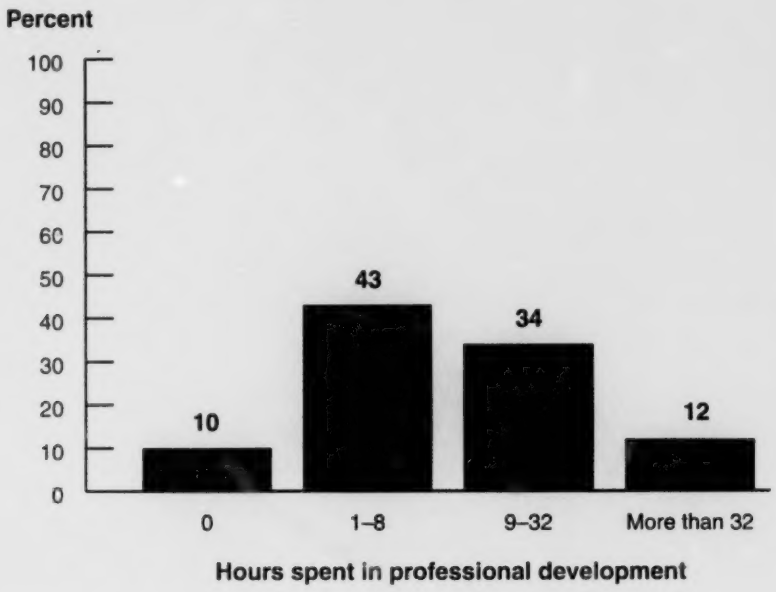
FIGURE 5.7.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING NUMBER OF HOURS SPENT IN PROFESSIONAL DEVELOPMENT ACTIVITIES IN THE USE OF COMPUTERS OR THE INTERNET DURING THE LAST 3 YEARS: 1999



NOTE: Percents may not sum to 100 due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

TABLE 5.4.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING FEELING PREPARED TO VARIOUS EXTENTS TO USE COMPUTERS AND THE INTERNET FOR INSTRUCTION, BY HOURS SPENT IN PROFESSIONAL DEVELOPMENT: 1999

Hours of professional development	Teachers' feelings of preparedness		
	Not at all	Somewhat	Well/very well
All public school teachers	**13**	**53**	**33**
0 hours	32	47	22
1-8 hours	19	55	26
9-32 hours	5	61	34
More than 32 hours	2	32	66

NOTE: Detail may not sum to 100 due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

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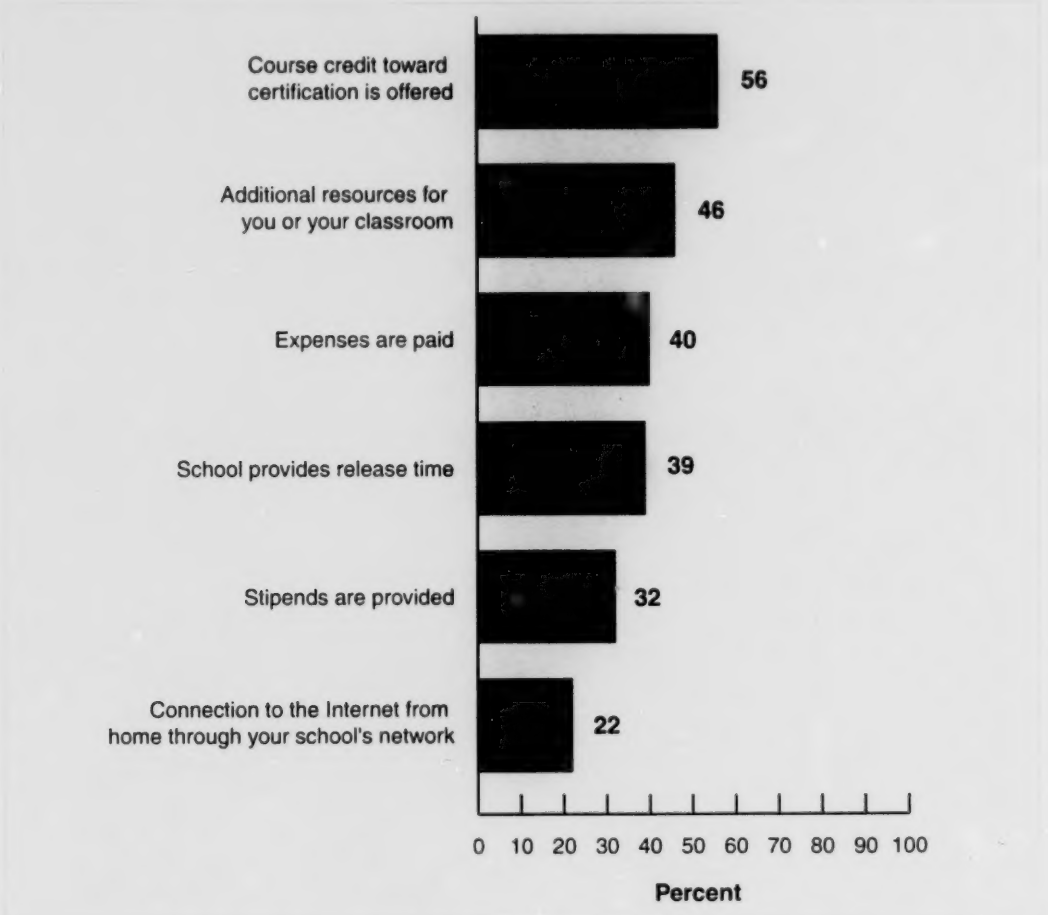
FIGURE 5.8.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING THE AVAILABILITY OF CERTAIN INCENTIVES FROM THE SCHOOL DISTRICT FOR PARTICIPATION IN PROFESSIONAL DEVELOPMENT: 1999



SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Teachers in small schools were more likely than teachers in larger schools to report the availability of such incentives as release time and paid expenses. For example, about half (53 percent) of the teachers in schools with less than 300 students reported the availability of release time, compared with a little over one-third (37 percent) of teachers in schools with 300 to 999 students and schools with 1,000 or more students (figure 5.9). On the other hand, teachers in medium and large schools were more likely than teachers in small schools to report the availability of connections to the Internet from home as an incentive to participate in technology training (22 percent and 24 percent, respectively, compared with 13 percent).

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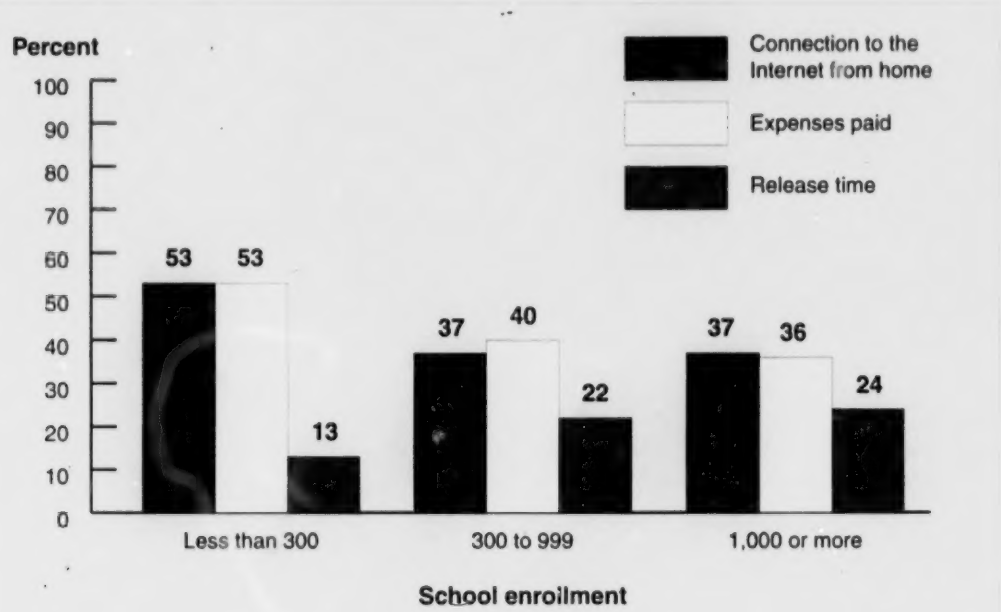
FIGURE 5.9.—PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING AVAILABILITY OF CERTAIN INCENTIVES FROM THE SCHOOL DISTRICT FOR PARTICIPATION IN PROFESSIONAL DEVELOPMENT, BY SCHOOL ENROLLMENT: 1999



SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

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Chapter 6

Barriers to Teachers' Use of Technology

Highlights

- In 1999, the barriers to the use of computer and the Internet for instruction most frequently reported by public school teachers were not enough computers, lack of release time for teachers to learn how to use computers or the Internet, and lack of time in schedule for students to use computers in class. Among the barriers most frequently reported by teachers to be "great" barriers to their use of computers or the Internet for instruction were not enough computers and lack of release time for teachers to learn how to use computers or the Internet.

- Teachers' perceptions of barriers to technology use varied by a number of teacher and school characteristics. For example, secondary teachers, teachers in large schools, and teachers in city schools were more likely than elementary teachers, teachers in small schools, and teachers in rural schools, respectively, to report that not enough computers was a great barrier. Additionally, elementary teachers were more likely to report the lack of time in the schedule for students to use computers in class as a great barrier than secondary teachers. Furthermore, teachers with more years of experience were generally more likely than less experienced teachers to cite the lack of release time to learn, practice, or plan ways to use computers or the Internet as a great barrier.

- Generally, teachers who perceived lacking computers and time for students to use computers as great barriers were less likely than those who did not perceive these conditions as barriers to assign students to use computers or the Internet for some instructional activities.

Barriers to Teachers' Use of Technology

CHAPTER 6

The 1999 FRSS survey asked teachers whether and the extent to which they encountered the following barriers to their use of school computers or the Internet for instruction:

- not enough computers,
- outdated, incompatible, or unreliable computers,
- lack of good instructional software,
- Internet access is not easily accessible,
- concern about student access to inappropriate materials,
- lack of release time for teachers to learn, practice, or plan ways to use computers or the Internet,
- lack of time in schedule for students to use computers in class,
- inadequate training opportunities,
- lack of administrative support,
- lack of support regarding ways to integrate telecommunications into the curriculum, and
- lack of technical support or advice.

This chapter first presents information on the extent to which teachers perceived these to be barriers, followed by an examination of differences by teacher and school characteristics. The final section of the report explores the relationships between barriers reported by teachers and selected instructional activities.

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FIGURE 6.1. PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING SMALL, MODERATE, OR GREAT BARRIERS TO THEIR USE OF COMPUTERS AND THE INTERNET FOR INSTRUCTION: 1999

NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the analyses presented in this figure. Detail may not sum to totals due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

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Barriers to Technology Use

In 1999, the barriers to the use of computer and the Internet for instruction most frequently reported by public school teachers were insufficient numbers of computers, lack of release time for teachers to learn how to use computers or the Internet, and lack of time in schedule for students to use computers in class (78 percent, 82 percent, and 80 percent of teachers, respectively—figure 6.1). In addition, 71 percent reported the lack of good instructional software, and 58 percent of teachers reported difficult Internet access as barriers. Furthermore, approximately two-thirds of all teachers reported the lack of adequate equipment, training opportunities, technical support or advice, and support regarding ways to integrate telecommunications into the curriculum as barriers (66 percent, 67 percent, 64 percent, and 68 percent, respectively). Fifty-nine percent also reported that a concern about student access to inappropriate materials was a barrier. Lack of administrative support was least likely to be reported as a barrier (43 percent). Among the barriers most frequently reported by teachers to be "great" barriers to their use of computers or the Internet for instruction in 1999 were not enough computers, lack of release time for teachers to learn how to use computers or the Internet, and lack of time in students' schedule to use technology (38 percent, 37 percent, and 32 percent, respectively).

Differences in Teachers' Reports of Great Barriers

Availability of and Access to Computers and the Internet

In order for teachers to integrate technology into their instruction, technology must be available and accessible to them. This section examines barriers to teachers' use of technology that involve availability of and access to computers and the Internet. More specifically, it looks at differences in teachers' reports of the lack of computers, lack of adequate computers, and difficulty accessing the Internet (38 percent, 25 percent, and 27 percent of teachers, respectively, reported these to be great barriers to their use of technology for instruction).

Teachers' reports that not having enough computers was a great barrier varied by instructional level, school size, and school location (table 6.1). Secondary teachers were more likely than elementary teachers to indicate that not having enough computers was a great barrier (43 percent compared with 36 percent). In addition, teachers in schools with 300 or more students were more likely than teachers in schools with fewer than 300 students to report that not having enough computers was a great barrier (38 percent and 46 percent, compared with 25 percent). Moreover, teachers in city schools were more likely than those in rural schools to report that not enough computers was a great barrier (43 percent compared with 31 percent).

TABLE 6.1. PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING VARIOUS BARRIERS AS GREAT BARRIERS TO THE USE OF COMPUTERS AND THE INTERNET FOR INSTRUCTION, BY SCHOOL CHARACTERISTICS: 1999

School characteristics	Great barriers		
	Not enough computers	Outdated, incompatible, or unreliable computers	Internet access not easily accessible
All public school teachers	**38**	**25**	**27**
Instructional level			
Elementary	36	27	28
Secondary	43	21	23
Enrollment size			
Less than 300	25	24	21
300 to 999	38	26	27
1,000 or more	46	24	27
Locale			
City	43	29	28
Urban fringe	39	25	27
Town	38	22	23
Rural	31	23	26
Percent minority enrollment in school			
Less than 6 percent	35	22	24
6 to 20 percent	35	22	20
21 to 49 percent	38	26	27
50 percent or more	45	32	36

NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the analyses presented in this table.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

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There were also differences in teachers' reports of outdated, incompatible, or unreliable computers being a barrier. For example, elementary teachers were more likely to report that this was a great barrier than secondary teachers (27 percent compared with 21 percent). Additionally, teachers in schools with more than 50 percent minority enrollments were more likely to cite outdated, incompatible, or unreliable computers as a great barrier than teachers in schools with less than 6 percent minority enrollments (32 percent compared with 22 percent).

Similar differences were found for not having easy Internet access as a barrier. Elementary teachers cited this barrier more frequently than secondary teachers (28 percent compared with 23 percent). Additionally, teachers in schools with more than 50 percent minority enrollments were more likely to report not having easy Internet access as a great barrier than teachers in schools with less than 6 percent minority enrollments and 6 to 20 percent minority enrollments (36 percent compared with 24 percent and 20 percent, respectively).

Lack of Time

Among the greatest barriers to the use of technology in instruction reported was lack of time. The section examines two types of time limitations. The first is the lack of release time for teachers to learn, practice, or plan ways to use computers or the Internet for instruction. The second is the lack of time in the schedule for students to use computers and the Internet in class.

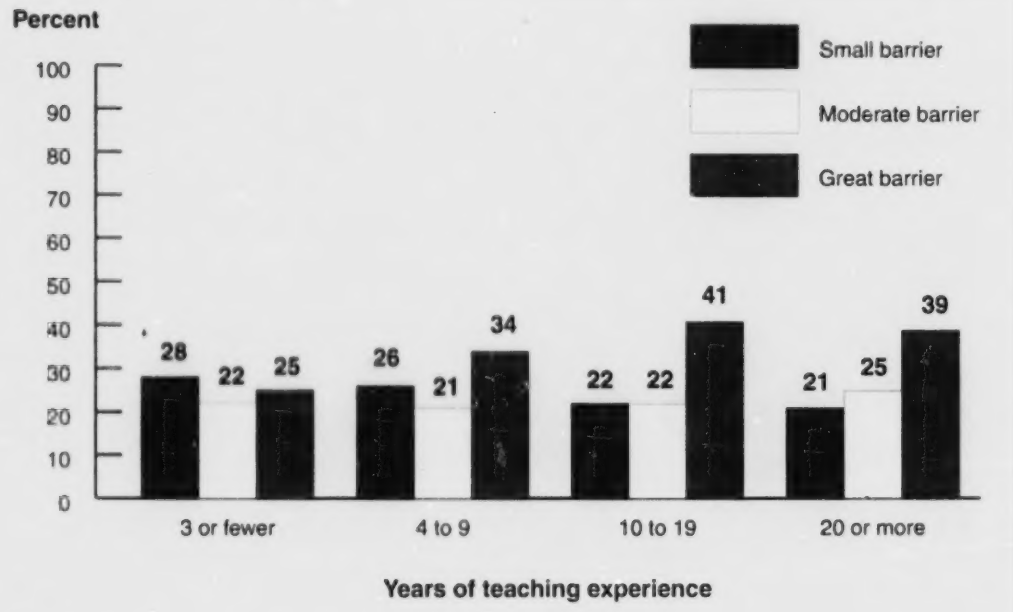
Although teachers' reports of lack of training opportunities did not differ significantly by teacher or school characteristics (table A-6.3), release time did (figure 6.2). Specifically, teachers with more years of teaching experience (10 to 19 years and 20 or more years of experience) were more likely than teachers with the least experience (3 or fewer years) to report that a lack of release time was a great barrier (41 percent and 39 percent, compared with 25 percent). Additionally, elementary teachers were more likely than secondary teachers to report a lack of time in the schedule for students to use computers and the Internet in class as a great barrier (34 percent compared with 28 percent—table A-6.3).

Institutional and Technical Support for Using Technology

This section examines teachers' perceptions of the lack of administrative and technical support, as well as lack of support regarding ways to integrate computers and the Internet into the curriculum as barriers to their use of computers and the Internet for instruction.

The lack of administrative support as a great barrier varied by years of teaching experience. Specifically, teachers with 10 to 19 years of experience cited this as a great barrier more frequently than teachers with 20 or more years of experience (13 percent compared with 7 percent—table A-6.3). There were also differences in teachers' reports of the lack of support regarding ways to integrate telecommunications into the curriculum as a great barrier by minority enrollments. That is, 24 percent of teachers in schools with 50 percent or more minority

FIGURE 6.2. PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING LACK OF RELEASE TIME TO LEARN, PRACTICE, OR PLAN WAYS TO USE TECHNOLOGY AS A SMALL, MODERATE, OR GREAT BARRIER TO THE USE OF COMPUTERS AND THE INTERNET FOR INSTRUCTION, BY YEARS OF TEACHING EXPERIENCE: 1999



NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the analyses presented in this figure.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

enrollments cited lack of support regarding ways to integrate telecommunications as a great barrier compared with 15 percent of teachers in schools with 6 to 20 percent minority enrollments, and 13 percent of teachers in schools with 21 to 49 percent minority enrollments (figure 6.3)

In addition, teachers in schools that did not have a technical coordinator in 1999 (20 percent—table A-6.3) were approximately two to three times as likely as teachers in schools with a technical coordinator to report the lack of institutional and technical support as a great barrier (figure 6.4). Specifically, 8 percent of teachers in schools with a technical coordinator cited lack of administrative support as a great barrier compared with 17 percent of teachers without this resource. Moreover, 15 percent of teachers with a technical coordinator perceived lack of support regarding ways to integrate technology into the curriculum as a great barrier, compared with 33 percent of teachers without a technology coordinator. Finally, 12 percent of teachers that had a technical coordinator available reported the lack of technical support or advice as a great barrier, compared with 39 percent of teachers without a technology coordinator.

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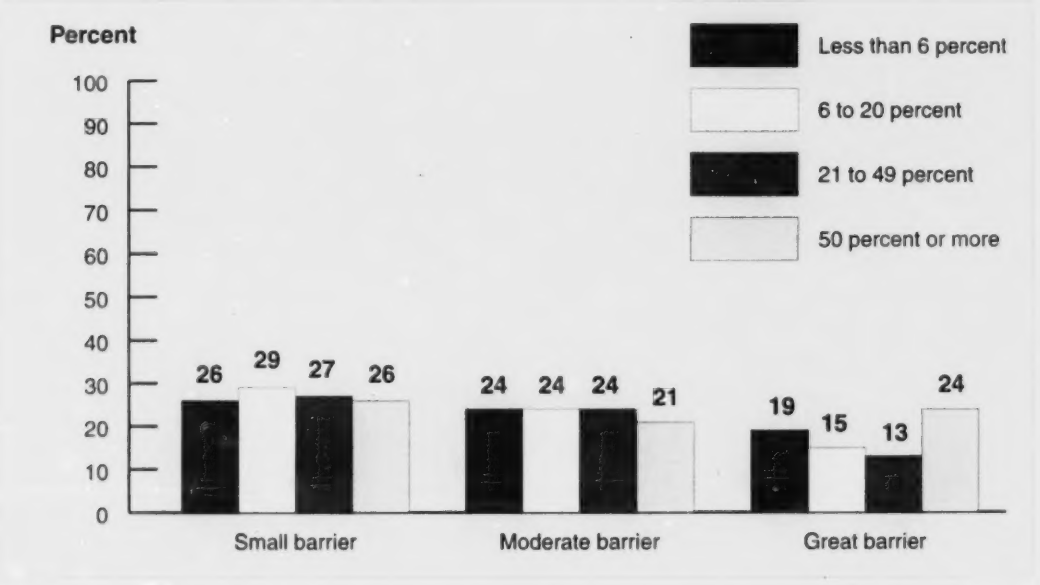
FIGURE 6.3. PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING LACK OF SUPPORT REGARDING WAYS TO INTEGRATE TECHNOLOGY INTO THE CURRICULUM AS A SMALL, MODERATE, OR GREAT BARRIER TO THE USE OF COMPUTERS AND THE INTERNET FOR INSTRUCTION, BY PERCENT MINORITY ENROLLMENT IN SCHOOL: 1999



NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the analyses presented in this figure.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Barriers and Teachers' Instructional Activities

Generally, teachers who perceived lacking computers and time for students to use computers as great barriers were less likely than those who did not perceive these conditions as barriers to assign students to use computers or the Internet for some instructional activities. For example, teachers who reported insufficient numbers of computers as a great barrier were less likely than teachers reporting that this was not a barrier to assign students to use computers or the Internet to a "large extent" for practicing drills (9 percent compared with 19 percent), word processing or creating spreadsheets (14 percent compared with 25 percent), and solving problems and analyzing data (6 percent compared with 13 percent—table 6.2). The pattern is similar for an additional barrier, lack of time in schedule for students to use computers in class, with the exception of Internet research—teachers who reported lack of time as a great barrier were less likely to do this than teachers who reported it as a small barrier.

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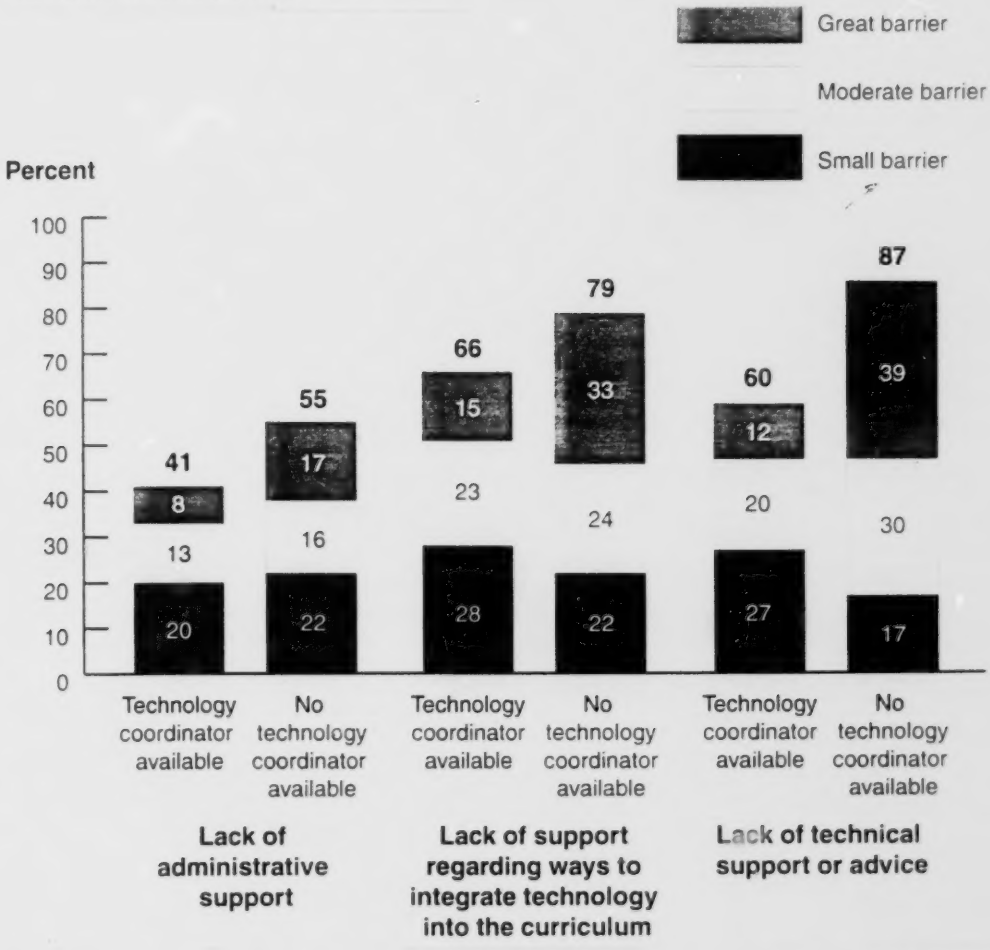
FIGURE 6.4. PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING LACK OF INSTITUTIONAL AND TECHNICAL SUPPORT AS SMALL, MODERATE, OR GREAT BARRIERS TO THE USE OF COMPUTERS AND THE INTERNET FOR INSTRUCTION, BY AVAILABILITY OF A TECHNOLOGY COORDINATOR: 1999



NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the analyses presented in this figure. Detail may not sum to totals due to rounding. First two bars read: 8 percent of teachers in schools with a technical coordinator cited lack of administrative support as a great barrier compared with 17 percent of teachers without this resource.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

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TABLE 6.2. PERCENT OF PUBLIC SCHOOL TEACHERS REPORTING USING COMPUTERS OR THE INTERNET FOR VARIOUS ACTIVITIES AT SCHOOL TO A LARGE EXTENT, BY EXTENT TO WHICH THEY PERCEIVED VARIOUS CONDITIONS TO BE BARRIERS TO COMPUTER AND INTERNET USE: 1999

	Activities			
Teachers' reports of barriers	Practice drills	Solve problems/ analyze data	Word processing/ spread-sheets	Internet research
All public school teachers	**12**	**8**	**20**	**12**
Not enough computers				
Not at all	19	13	25	13
Small barrier	13	7	22	13
Moderate barrier	10	7	23	14
Great barrier	9	6	14	9
Lack of time in schedule				
Not at all	18	18	25	12
Small barrier	12	8	25	18
Moderate barrier	12	4	19	10
Great barrier	8	6	15	9

NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the analyses presented in this table.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

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CHAPTER 7

Conclusions

Teacher Use of Technology

The research literature on education technology has typically focused on the availability of technology in the nation's public schools and classrooms and reported that the availability has grown substantially. However, there is much less research on whether, how frequently, and in what manner these technologies are being used. The research that does exist suggests that as availability has grown, so has the number of students and teachers using computers and the frequency with which they use them (Levin et al., 1998). According to the literature, however, the advent of computers and the Internet has not dramatically changed how teachers teach and how students learn. Computers have typically been used for traditional methods of teaching (e.g., drill and practice and computer education—Becker, 1983; Becker, 1984); although the more recent data suggest that some teachers are using technology in more innovative ways (e.g., solve problems, conduct research—Becker, 1999; Fulton, 1997).

The most recent data on teachers' technology use, provided by the 1999 FRSS teacher survey, indicate that approximately half of all public school teachers used computers or the Internet for classroom instruction in 1999. And teachers' use of technology can be characterized as reflecting a mixture of traditional and innovative teaching methods. For example, teachers using computers for instruction assigned students to use computers or the Internet for practicing drills and word processing or creating spreadsheets frequently in 1999. However, they also frequently assigned students to use computers and the Internet for research and solving problems and analyzing data.

In addition to classroom instruction, the 1999 survey indicates that teachers also used computers to prepare for instruction and to communicate with others. Specifically, many teachers used computers or the Internet to conduct a number of preparatory and administrative tasks (e.g., creating instructional materials, gathering information for planning lessons) and communicative (e.g., communication with colleagues) tasks. However,

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teachers used these technologies less frequently for such tasks as accessing research, best practices examples, and model lesson plans, as well as communicating with parents and students.

Teachers' use of computers or the Internet for instructional purposes was related to their training and preparation and work environments. As described in more detailed below, teachers were more likely to use these technologies when the technologies were available to them, available in their classrooms as opposed to computer labs, and available in greater numbers. Moreover, teachers who reported feeling better prepared were more likely to use these technologies than their less prepared colleagues. (Teachers who spent more time in professional development reported feeling better prepared than their colleagues.) Finally, teachers who perceived lacking computers and time for students to use computers as great barriers were less likely than their colleagues to assign students to use computers or the Internet for some instructional activities.

Teachers' Training and Preparation

Research on teacher training and preparation for technology use often focuses on professional development opportunities or pre-service training. Generally, traditional professional development activities have been criticized for lacking continuity and follow-up (Fullan with Stiegelbauer, 1991), and pre-service training has been criticized as being fragmented and unconnected to real classroom experiences (NCTAF, 1996). Despite these criticisms, 88 percent of teachers indicated that professional development activities prepared them to some extent to use technology, and 84 percent of teachers with 3 or fewer years of teaching experience indicated that college/graduate work prepared them to some extent to use technology. However, a relatively small proportion of teachers indicated that these sources prepared them to a "large extent."

Results presented in this report also indicate that professional development and teachers' feelings of preparation are related. Specifically, teachers who spent more time in professional development activities on technology use indicated that they felt better prepared to use technology for classroom instruction than those who spent less time in these activities. Furthermore, teachers who reported that they felt better prepared to use technology were more likely to use it than teachers who reported feeling less prepared. However, these findings are descriptive and not causal in nature. For example, results presented in this paragraph may suggest that if teachers spend more time in professional development activities, their feeling of preparedness will increase. On the other hand, these findings may also suggest that teachers who feel more prepared to use technology tend to seek out more opportunities to learn about this topic.

Teachers' Work Environment

As described in the introductory chapter, teachers' ability and willingness to use computers and the Internet may depend, to some extent, on the schools and classrooms in which they work. On the most basic level, for example, teachers may be more likely to integrate computers and the Internet into classroom instruction if they have access to adequate equipment and connections and if they have time to learn about these technologies and use them in their classrooms.

With respect to the availability of and access to technology, the findings presented in this report indicate that both have grown dramatically over the past decade. A majority of classrooms have at least one computer, many of these computers have Internet connections, and a large number of teachers and students have these technologies available at home as well. In addition, nearly all teachers with such technology available to them used the computers and the Internet connections in their schools, and most reported that their students used computers and the Internet in the school as well.

Despite high levels of availability and use, however, many teachers reported facing a number of barriers to the use of technology in their schools. The barriers to the use of computer and the Internet for instruction most frequently reported by public school teachers were insufficient numbers of computers, lack of release time for teachers to learn how to use computers or the Internet, and lack of time in schedule for students to use computers in class. In fact, while it is true that most schools now have computers and the Internet available somewhere in their schools, this availability is still somewhat limited in the classroom; among teachers who reported having any computers in their classrooms, it was most common to have one computer. With one classroom computer, teachers may have the technology they need to prepare for lessons and use computers for demonstrative purposes during classroom instruction; however, it may be difficult to have students use computers under these conditions. Indeed, teachers who did not use computers or the Internet were more likely to report insufficient numbers of computers and lack of time as great barriers than teachers who used these technologies. Additionally, teachers with more computers in their classrooms generally used technology for instructional purposes more frequently. These findings are descriptive and not causal. For example, teachers may be more inclined to use computers once they are placed in their classrooms. On the other hand, teachers who are more inclined to use computers may actively seek to acquire them for their classrooms.

Teacher and School Characteristics

Years of Teaching Experience

As discussed in the introductory chapter of this report, there are a number of factors that contribute to the success or failure of instructional reforms, including the use of technology for classroom instruction. One important factor is that teachers do not always have opportunities to learn about and practice instructional reforms. One way prospective teachers learn how to use computers is through their teacher preparation programs. And although some observers have argued that prospective teachers are not getting the training they need to successfully integrate technology into classroom instruction (President's Committee of Advisors on Science and Technology, 1997), recent graduates of teacher preparation programs are more likely to have received some instruction in technology use than teachers who graduated one or two decades ago. In fact, teachers with fewer years of teaching experience were more likely than their more experienced colleagues to indicate that college/graduate work prepared them to use computers and the Internet. Indeed, less experienced teachers used technology (e.g., e-mail, the

Internet, computers) more frequently than their more experienced colleagues for a variety of purposes (e.g., to gather information for planning lessons, create instructional materials, access research, best practices examples, model lesson plans).

On the other hand, practicing teachers often learn from professional development activities, and may be more likely to learn about technology from such activities. As findings presented in this report indicate, more experienced teachers were more likely than their less experienced colleagues to take advantage of the professional development activities on technology use that were available to them. Despite their higher participation in professional development, however, more experienced teachers were less likely than less experienced teachers to indicate that they felt "well prepared" or "very well prepared" to use technology for classroom instruction.

Minority Enrollment and Poverty Concentration

Among teachers with technology available in their schools, teachers in low minority schools (less than 6 percent) and lower poverty schools (less than 11 percent) were generally more likely than teachers in higher minority schools (50 percent or more minority enrollments) and higher poverty schools (50 to 70 percent or 71 percent or more students eligible for free or reduced-price lunch) to use computers or the Internet at school for a wide range of activities, including creating instructional materials, communicating with colleagues, and instructing students. Features of these schools may provide a context for understanding these findings. For example, teachers in high minority schools were less likely than those in some lower minority schools to have computers (77 percent of teachers in schools with minority enrollments of 50 percent or more compared with 89 percent of teachers in schools with minority enrollments of 21 to 49 percent) or the Internet (69 percent of teachers in schools with minority enrollments of less than 6 percent and 71 percent of teachers in schools with minority enrollments of 6 to 20 percent compared with 51 percent of teachers in schools with minority enrollments of 50 percent or more) in their classrooms.

Furthermore, teachers in high minority schools were generally more likely than teachers in low minority schools to cite a number of barriers to technology use, including outdated, incompatible, or unreliable computers, easy Internet access, and the lack of support regarding ways to integrate telecommunications. In addition, teachers in high poverty schools generally had fewer computers with Internet connections available in their classrooms or elsewhere in the school than teachers in lower poverty schools. Moreover, teachers in high poverty and high minority schools generally were less likely to report that training in Internet use was available to them.

Instructional Level

There were a number of differences between elementary and secondary teachers in their use of technology. For example, elementary teachers were more likely than secondary teachers to use technology for classroom instruction and to communicate with parents. In addition, elementary teachers were more likely than secondary teachers to assign students to use computers or the Internet to practice drills and to solve problems and analyze data. On the other hand, secondary

teachers were more likely than elementary teachers to use computers or the Internet for administrative record keeping, to communicate with students, and to assign students to use these technologies to conduct Internet research. Furthermore, elementary teachers were more likely than secondary teachers to assign projects using the computer *inside* the classroom, whereas, secondary teachers were more likely than elementary teachers to assign projects using the computer *outside* of the classroom. Elementary teachers were also more likely than secondary teachers to report that their students used computers at school; however, secondary teachers were more likely than elementary teachers to report that their students used the Internet at school.

Features of elementary and secondary teachers' schools may provide a context for these differences. For example, secondary teachers may have reported that their students used computers inside the classroom less often than elementary teachers because secondary teachers were less likely to have computers in their classrooms and had fewer classroom computers than elementary teachers. In fact, secondary teachers were more likely than elementary teachers to indicate that insufficient numbers of computers was a great barrier to use of computers or the Internet for instruction. On the other hand, secondary teachers may have reported that their students used the Internet more often than elementary teachers because secondary teachers were more likely than elementary teachers to have the Internet available on the computers that they did have in their classrooms, and they were also more likely to have Internet availability elsewhere in the school. In fact, elementary teachers cited not having easy Internet access as a barrier more frequently than secondary teachers.

New Directions

Although the findings presented in this report provide important information about a topic—teachers' use of advanced education technology—that has not been well documented previously, they do not address many emerging policy issues, including the following policy questions:

- How does the use of computers, the Internet and other applications by teachers and students affect student performance, knowledge, and skills?
- What is the impact of computer and Internet use on the way teachers teach and students learn, and what is the impact, more broadly, on educational reform?
- How does the investment in technology compare with other educational innovations, such as smaller classes or individualized instruction, in terms of costs and benefits?

In addition to the questions listed above, fruitful topics for future research include the following:

- updated information on the types of technologies that are available in schools (e.g., quality/speed, types of Internet connections, software applications);

- organizational changes to schools that will enable the increased use of technology (e.g., administrative efficiency, home-school connections, collegial communication) or the sustainability of technology implementation and use;
- fiscal expenditures on educational technology at the school, district, state, and especially national levels;
- professional development and technical support strategies for enhancing teachers' effective use of technology;
- in-depth understanding of the duration and types of technology uses for teaching and learning both inside and outside of the school (e.g., subject specific uses);
- the effects of different types of technology applications on particular types of students (e.g., limited English proficient, special education, gifted and talented).

New NCES Data Sources for Education Technology Issues

Throughout 1999 and 2000, a number of NCES surveys were collecting a wide range of information on the use of education technology. These data may fill in some of the gaps in the educational technology literature and may provide more detail on topics addressed in the 1999 FRSS teacher survey. For example, the 2000 FRSS school technology survey will provide the most recent data on the availability of computers and the Internet in public schools. Furthermore, the 1999-2000 Schools and Staffing Survey (SASS), an extensive survey with a large sample of public, private, Bureau of Indian Affairs, and charter schools and detailed information on teachers' characteristics and practices, includes a number of questions about technology. For example, SASS collected data in areas such as expenditures on computer hardware, the types of technology available in media centers, and school staffing for both technical support and the integration of technology into the classroom for teaching and learning in 1999-2000.

The 2001 National Assessment of Educational Progress (NAEP) will be collecting detailed data in a number of new areas: the age and quality of school computers, schools' participation in community programs and grant programs such as the E-rate, details of schools' technology plans, and student perceptions of their own technology skills. NAEP 2001 items also cover subject-specific student uses of technology, student attitudes about technology, and teacher ratings of availability of technology, quality of technical support, and usefulness of computers in the classroom.

Finally, the Early Childhood Longitudinal Study (ECLS) collected data on technology at the kindergarten level. ECLS 1998-99 items inquired about the number of computers in schools, the perceived adequacy and physical condition of computer labs, the presence of technology in classrooms, and kindergarten students' use of technology. The ECLS will collect longitudinal data on student achievement and teacher practices, which may be used to link these measures to various items related to technology.

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Appendix A

Standard Error Tables
for Text Tables and Figures

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Table A-2.1a.—Standard errors of the percent of public school teachers who have computers at school or at home reporting using computers or the Internet a little or a lot at school and at home for various activities, by school and teacher characteristics: 1999

School and teacher characteristics	Activities					
	Create instructional materials		Gather information for lesson plans		Administrative record keeping	
	At school	At home	At school	At home	At school	At home
All public school teachers	**1.13**	**0.98**	**1.41**	**1.37**	**1.48**	**1.56**
Instructional level						
Elementary	1.49	1.26	1.86	1.84	1.98	2.10
Secondary	1.69	1.59	2.04	1.94	2.03	2.19
Enrollment size						
Less than 300	3.18	3.44	3.49	4.11	4.20	4.21
300 to 999	1.37	1.20	1.82	1.75	1.84	1.95
1,000 or more	2.50	1.90	2.69	2.57	3.00	3.27
Locale						
City	2.19	2.04	2.61	2.77	2.88	3.06
Urban fringe	1.92	1.47	2.38	2.16	2.50	2.52
Town	2.74	2.18	3.35	3.12	3.31	4.09
Rural	2.28	2.44	3.17	3.29	3.21	3.34
Percent minority enrollment in school						
Less than 6 percent	2.13	1.83	2.66	2.50	2.75	2.72
6 to 20 percent	2.18	1.88	2.76	3.04	3.08	3.53
21 to 49 percent	2.13	1.84	2.76	2.65	2.86	3.34
50 percent or more	2.52	2.24	2.84	2.90	3.12	3.09
Percent of students in school eligible for free or reduced-price school lunch						
Less than 11 percent	2.22	2.39	3.48	3.60	4.11	4.32
11 to 30 percent	1.87	1.62	2.43	2.34	2.63	2.91
31 to 49 percent	2.66	2.00	3.15	3.27	3.29	3.61
50 to 70 percent	3.05	2.76	3.70	3.55	3.76	3.66
71 percent or more	3.30	2.80	3.81	3.54	4.10	4.10
Teaching experience						
3 or fewer years	3.16	2.28	3.80	3.56	3.87	4.11
4 to 9 years	2.16	2.12	2.81	2.81	3.00	3.21
10 to 19 years	2.01	1.87	2.54	2.77	2.57	2.93
20 or more years	1.82	1.72	2.18	2.19	2.22	2.39

See note at end of table.

Table A-2.1a.—Standard errors of the percent of public school teachers who have computers at school or at home reporting using computers or the Internet a little or a lot at school and at home for various activities, by school and teacher characteristics: 1999—Continued

School and teacher characteristics	Activities					
	Access research and best practice examples		Multimedia presentations		Access model lesson plans	
	At school	At home	At school	At home	At school	At home
All public school teachers	**1.34**	**1.47**	**1.35**	**1.46**	**1.30**	**1.49**
Instructional level						
Elementary	1.78	1.98	1.81	1.98	1.73	2.01
Secondary	1.92	2.05	1.88	2.03	1.92	2.00
Enrollment size						
Less than 300	3.76	4.35	3.75	3.78	3.76	4.30
300 to 999	1.75	1.87	1.76	1.83	1.66	1.91
1,000 or more	2.27	2.82	2.35	3.03	2.41	2.76
Locale						
City	2.53	2.88	2.56	2.80	2.50	2.88
Urban fringe	2.10	2.43	2.34	2.49	2.08	2.53
Town	3.83	3.47	2.91	3.44	3.18	3.39
Rural	3.03	3.19	2.96	3.04	3.06	3.27
Percent minority enrollment in school						
Less than 6 percent	2.64	2.68	2.66	2.89	2.42	2.51
6 to 20 percent	2.64	3.03	2.97	2.99	2.69	3.21
21 to 49 percent	2.60	3.12	2.42	3.00	2.67	3.24
50 percent or more	2.82	2.98	2.70	2.83	2.67	2.99
Percent of students in school eligible for free or reduced-price school lunch						
Less than 11 percent	3.34	3.70	3.46	3.99	2.97	4.02
11 to 30 percent	2.42	2.54	2.59	2.69	2.38	2.69
31 to 49 percent	3.08	3.56	2.76	3.04	3.15	3.11
50 to 70 percent	3.06	3.95	3.27	4.03	3.01	3.98
71 percent or more	3.85	3.64	3.79	3.49	3.69	3.76
Teaching experience						
3 or fewer years	3.65	4.15	3.61	3.86	3.57	4.07
4 to 9 years	2.77	3.02	2.87	3.12	2.70	3.11
10 to 19 years	2.49	2.83	2.50	2.68	2.42	2.87
20 or more years	2.03	2.28	1.95	2.18	1.93	2.21

NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the "At school" analyses presented in this table. Teachers who reported not having a computer available at home were excluded from the "At home" analyses presented in this table.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Table A-2.2a.—Standard errors of the percent of public school teachers who have computers at school or at home reporting using computers or the Internet a little or a lot at school and at home, for various activities, by school and teacher characteristics: 1999

School and teacher characteristics	Activities			
	Communicate with colleagues		Communicate with parents	
	At school	At home	At school	At home
All public school teachers	**1.70**	**1.43**	**1.35**	**1.12**
Instructional level				
Elementary	2.29	1.92	1.82	1.55
Secondary	2.33	1.98	1.86	1.40
Enrollment size				
Less than 300	4.05	4.35	3.44	3.41
300 to 999	2.13	1.83	1.72	1.44
1,000 or more	3.61	2.56	2.71	2.05
Locale				
City	3.10	2.66	2.42	2.07
Urban fringe	3.03	2.47	2.36	1.95
Town	3.67	3.57	3.48	2.58
Rural	3.61	2.82	2.76	2.51
Percent minority enrollment in school				
Less than 6 percent	3.09	2.87	2.64	2.19
6 to 20 percent	3.30	3.02	3.18	2.33
21 to 49 percent	3.72	2.86	2.75	2.32
50 percent or more	3.21	2.66	1.90	2.17
Percent of students in school eligible for free or reduced-price school lunch				
Less than 11 percent	4.37	3.51	3.55	2.77
11 to 30 percent	3.09	2.51	2.63	2.08
31 to 49 percent	3.96	3.41	3.38	2.50
50 to 70 percent	3.99	3.75	3.02	3.20
71 percent or more	3.99	3.53	2.77	2.68
Teaching experience				
3 or fewer years	3.77	4.07	2.81	3.04
4 to 9 years	3.06	3.09	2.43	2.52
10 to 19 years	2.74	2.78	2.33	2.13
20 or more years	2.33	2.30	2.04	1.74

See note at end of table.

Table A-2.2a.—Standard errors of the percent of public school teachers who have computers at school or at home reporting using computers or the Internet a little or a lot at school and at home, for various activities, by school and teacher characteristics: 1999—Continued

School and teacher characteristics	Activities			
	Post homework/ assignments		Communicate with students	
	At school	At home	At school	At home
All public school teachers	**0.99**	**0.99**	**0.84**	**1.00**
Instructional level				
Elementary	1.29	1.32	1.06	1.30
Secondary	1.58	1.42	1.43	1.61
Enrollment size				
Less than 300	2.26	2.16	1.92	2.69
300 to 999	1.26	1.21	1.09	1.25
1,000 or more	2.02	2.16	1.65	2.11
Locale				
City	1.97	2.03	1.59	1.78
Urban fringe	1.54	1.56	1.37	1.79
Town	2.73	2.78	2.19	2.24
Rural	2.21	2.02	1.89	2.19
Percent minority enrollment in school				
Less than 6 percent	1.97	1.83	1.68	1.81
6 to 20 percent	1.92	1.69	1.95	2.29
21 to 49 percent	2.01	1.93	1.72	2.06
50 percent or more	2.08	2.44	1.38	1.87
Percent of students in school eligible for free or reduced-price school lunch				
Less than 11 percent	2.26	2.15	1.99	2.26
11 to 30 percent	1.61	1.68	1.75	1.99
31 to 49 percent	2.50	2.27	2.10	2.32
50 to 70 percent	2.52	2.72	1.78	2.45
71 percent or more	2.95	3.27	1.88	2.27
Teaching experience				
3 or fewer years	2.76	2.93	2.22	2.64
4 to 9 years	2.11	2.12	1.82	2.34
10 to 19 years	2.06	1.72	1.57	1.88
20 or more years	1.52	1.53	1.29	1.46

NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the "At school" analyses presented in this table. Teachers who reported not having a computer available at home were excluded from the "At home" analyses presented in this table.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Table A-2.3a.—Standard errors of the percent of public school teachers who have computers at school reporting use of computers or the Internet for instruction during class time, by school and teacher characteristics: 1999

School and teacher characteristics	Percent
All public school teachers	**1.36**
Instructional level	
Elementary	1.83
Secondary	1.94
Enrollment size	
Less than 300	3.96
300 to 999	1.74
1,000 or more	2.51
Locale	
City	2.77
Urban fringe	2.25
Town	2.93
Rural	3.16
Percent minority enrollment in school	
Less than 6 percent	2.58
6 to 20 percent	2.72
21 to 49 percent	2.89
50 percent or more	2.87
Percent of students in school eligible for free or reduced-price school lunch	
Less than 11 percent	3.23
11 to 30 percent	2.67
31 to 49 percent	2.87
50 to 70 percent	3.25
71 percent or more	4.00
Teaching experience	
3 or fewer years	3.51
4 to 9 years	2.78
10 to 19 years	2.69
20 or more years	2.04

NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the analyses presented in this table.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Table A-2.4a.—Standard errors of the percent of public school teachers who have computers at school assigning students to do various activities with computers or the Internet to any extent, by school and teacher characteristics: 1999

School and teacher characteristics	Activities				
	Word processing/ spreadsheets	Internet research	Drills	Solve problems/ analyze data	CD-ROM research
All public school teachers	**1.40**	**1.51**	**1.40**	**1.41**	**1.51**
Instructional level					
Elementary	1.90	2.08	1.88	1.88	2.06
Secondary	1.89	1.99	1.80	2.02	1.98
Enrollment size					
Less than 300	3.66	3.80	3.66	3.80	3.71
300 to 999	1.78	1.95	1.81	1.80	1.92
1,000 or more	2.78	2.97	2.42	2.74	3.08
Locale					
City	2.65	2.85	2.69	2.66	2.79
Urban fringe	2.30	2.56	2.47	2.32	2.45
Town	3.20	3.50	3.82	3.75	3.83
Rural	3.27	3.61	3.23	3.22	3.50
Percent minority enrollment in school					
Less than 6 percent	2.45	2.91	2.61	2.62	2.81
6 to 20 percent	3.15	3.03	2.89	2.90	2.79
21 to 49 percent	2.90	3.17	3.24	2.96	3.19
50 percent or more	2.67	3.05	3.07	2.95	3.12
Percent of students in school eligible for free or reduced-price school lunch					
Less than 11 percent	3.82	4.31	3.74	3.42	3.67
11 to 30 percent	2.56	2.73	2.66	2.65	2.84
31 to 49 percent	3.17	3.46	3.29	3.17	3.11
50 to 70 percent	3.47	3.48	3.90	3.84	4.06
71 percent or more	3.40	3.79	3.85	3.65	3.88
Teaching experience					
3 or fewer years	3.77	3.94	3.95	3.77	3.86
4 to 9 years	2.77	3.12	2.92	2.83	2.98
10 to 19 years	2.75	2.75	2.70	2.75	2.73
20 or more years	2.14	2.25	2.14	2.22	2.36

See note at end of table.

Table A-2.4a.—Standard errors of the percent of public school teachers who have computers at school assigning students to do various activities with computers or the Internet to any extent, by school and teacher characteristics: 1999—Continued

School and teacher characteristics	Activities			
	Multimedia projects	Graphical presentations	Demonstrations/ simulations	Correspondence with experts
All public school teachers	**1.51**	**1.48**	**1.47**	**1.24**
Instructional level				
Elementary	2.07	2.01	2.00	1.67
Secondary	1.97	2.00	1.94	1.74
Enrollment size				
Less than 300	3.38	3.62	3.62	3.30
300 to 999	1.94	1.88	1.88	1.56
1,000 or more	3.09	3.11	2.96	2.55
Locale				
City	2.82	2.72	2.71	2.28
Urban fringe	2.54	2.47	2.53	2.10
Town	3.91	3.75	3.70	2.98
Rural	3.18	3.38	2.96	2.83
Percent minority enrollment in school				
Less than 6 percent	2.73	2.80	2.48	2.54
6 to 20 percent	3.20	3.09	3.15	2.61
21 to 49 percent	3.15	3.11	3.18	2.49
50 percent or more	2.91	2.85	2.94	2.10
Percent of students in school eligible for free or reduced-price school lunch				
Less than 11 percent	4.10	3.96	3.95	3.83
11 to 30 percent	2.90	2.63	2.63	2.27
31 to 49 percent	3.17	3.35	3.40	2.49
50 to 70 percent	3.94	4.25	4.05	2.99
71 percent or more	3.72	3.66	3.83	2.74
Teaching experience				
3 or fewer years	4.06	3.84	3.92	3.07
4 to 9 years	2.97	2.93	3.12	2.60
10 to 19 years	2.71	2.79	2.70	2.40
20 or more years	2.31	2.22	2.16	1.86

NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the analyses presented in this table.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Table A-2.5.—Standard errors for the figures and for data not shown in tables in chapter 2: FRSS 1999 and NAEP 1992, 1994, 1996, 1998

Item	Estimate	Standard error
Figure 2.1: Percent of 4th- and 8th- grade public school students who have teachers reporting student use of computers for various class activities: 1998		
Write drafts: 4th-grade	61	2.65
Write drafts: 8th-grade	62	2.74
Read stories: 4th-grade	52	2.10
Read stories: 8th-grade	41	2.47
Practice spelling, punctuation, and grammar: 4th-grade	50	2.11
Practice spelling, punctuation, and grammar: 8th-grade	33	2.36
Figure 2.2: Percent of 8th- grade public school students who have teachers reporting student use of computers to write drafts and practice spelling, punctuation, and grammar: 1992 and 1998		
Write drafts: 1992	35	3.13
Write drafts: 1998	63	2.32
Practice spelling, punctuation, and grammar: 1992	15	1.99
Practice spelling, punctuation, and grammar: 1998	32	1.86
Figure 2.3: Percent of public school teachers who have computers at school or at home reporting using computers or the Internet a little or a lot at school and at home, for various tasks: 1999		
Create instructional materials: at school: a little	39	1.28
Create instructional materials: at school: a lot	39	1.35
Create instructional materials: at school: to any extent	78	1.13
Create instructional materials: at home: a little	36	1.37
Create instructional materials: at home: a lot	50	1.42
Create instructional materials: at home: to any extent	85	0.98
Gather information for lesson plans: at school: a little	43	1.35
Gather information for lesson plans: at school: a lot	16	0.93
Gather information for lesson plans: at school: to any extent	59	1.41
Gather information for lesson plans: at home: a little	38	1.38
Gather information for lesson plans: at home: a lot	29	1.29
Gather information for lesson plans: at home: to any extent	67	1.37
Administrative record keeping: at school: a little	16	0.99
Administrative record keeping: at school: a lot	34	1.39
Administrative record keeping: at school: to any extent	51	1.48
Administrative record keeping: at home: a little	18	1.11
Administrative record keeping: at home: a lot	26	1.32
Administrative record keeping: at home: to any extent	44	1.56
Access best practice examples: at school: a little	30	1.24
Access best practice examples: at school: a lot	7	0.66
Access best practice examples: at school: to any extent	37	1.34
Access best practice examples: at home: a little	33	1.36
Access best practice examples: at home: a lot	14	0.97
Access best practice examples: at home: to any extent	46	1.47
Multimedia presentations: at school: a little	28	1.18
Multimedia presentations: at school: a lot	8	0.75
Multimedia presentations: at school: to any extent	36	1.35
Multimedia presentations: at home: a little	23	1.36
Multimedia presentations: at home: a lot	8	0.76
Multimedia presentations: at home: to any extent	30	1.46
Access model lesson plans: at school: a little	28	1.23
Access model lesson plans: at school: a lot	6	0.62
Access model lesson plans: at school: to any extent	34	1.30
Access model lesson plans: at home: a little	29	1.35
Access model lesson plans: at home: a lot	13	1.03
Access model lesson plans: at home: to any extent	42	1.49

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Table A-2.5.—Standard errors for the figures and for data not shown in tables in chapter 2: FRSS 1999 and NAEP 1992, 1994, 1996, 1998—Continued

Item	Estimate	Standard error
Figure 2.4: Percent of public school teachers who have computers at school or at home reporting using computers or the Internet a little or a lot at school and at home, for various tasks: 1999		
Communicate with colleagues: at school: a little	27	1.28
Communicate with colleagues: at school: a lot	23	1.39
Communicate with colleagues: at school: to any extent	50	1.70
Communicate with colleagues: at home: a little	32	1.32
Communicate with colleagues: at home: a lot	16	1.03
Communicate with colleagues: at home: to any extent	48	1.43
Communicate with parents: at school: a little	18	1.16
Communicate with parents: at school: a lot	7	0.69
Communicate with parents: at school: to any extent	25	1.35
Communicate with parents: at home: a little	13	0.95
Communicate with parents: at home: a lot	6	0.68
Communicate with parents: at home: to any extent	19	1.12
Post homework/assignments: at school: a little	12	0.85
Post homework/assignments: at school: a lot	5	0.58
Post homework/assignments: at school: to any extent	17	0.99
Post homework/assignments: at home: a little	8	0.81
Post homework/assignments: at home: a lot	5	0.62
Post homework/assignments: at home: to any extent	13	0.99
Communicate with students: at school: a little	10	0.80
Communicate with students: at school: a lot	2	0.29
Communicate with students: at school: to any extent	12	0.84
Communicate with students: at home: a little	12	0.92
Communicate with students: at home: a lot	3	0.47
Communicate with students: at home: to any extent	14	1.00
Figure 2.5: Percent of public school teachers who have computers at school reporting assigning projects using computers, inside and outside the classroom, by instructional level: 1999		
All public school teachers: inside classroom	53	1.45
All public school teachers: outside classroom	48	1.39
Instructional level: elementary: inside classroom	60	1.98
Instructional level: elementary: outside classroom	41	1.84
Instructional level: secondary: inside classroom	37	1.82
Instructional level: secondary: outside classroom	64	1.89
Figure 2.6: Percent of public school teachers who have computers at school assigning students different types of work using computers or the Internet to a small, moderate, or large extent: 1999		
Word processing/spreadsheets: small extent	20	1.11
Word processing/spreadsheets: moderate extent	21	1.16
Word processing/spreadsheets: large extent	20	1.09
Word processing/spreadsheets: to any extent	61	1.40
Internet research: small extent	21	1.12
Internet research: moderate extent	19	1.07
Internet research: large extent	12	0.84
Internet research: to any extent	51	1.51
Solve problems/analyze data: small extent	23	1.21
Solve problems/analyze data: moderate extent	19	1.11
Solve problems/analyze data: large extent	8	0.75
Solve problems/analyze data: to any extent	50	1.41
Drills: small extent	19	1.09
Drills: moderate extent	19	1.07
Drills: large extent	12	0.96
Drills: to any extent	50	1.40

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Table A-2.5.—Standard errors for the figures and for data not shown in tables in chapter 2: FRSS 1999 and NAEP 1992, 1994, 1996, 1998—Continued

Item	Estimate	Standard error
CD-ROM research: small extent	21	1.12
CD-ROM research: moderate extent	18	1.03
CD-ROM research: large extent	9	0.76
CD-ROM research: to any extent	48	1.51
Multimedia projects: small extent	21	1.14
Multimedia projects: moderate extent	16	1.03
Multimedia projects: large extent	7	0.73
Multimedia projects: to any extent	45	1.51
Graphical presentations: small extent	24	1.21
Graphical presentations: moderate extent	13	0.89
Graphical presentations: large extent	6	0.66
Graphical presentations: to any extent	43	1.48
Demonstrations/simulations: small extent	22	1.19
Demonstrations/simulations: moderate extent	11	0.87
Demonstrations/simulations: large extent	5	0.60
Demonstrations/simulations: to any extent	39	1.47
Correspondence with experts: small extent	16	1.05
Correspondence with experts: moderate extent	5	0.60
Correspondence with experts: large extent	2	0.40
Correspondence with experts: to any extent	23	1.24
Chapter 2, section on computer use for reading and writing instruction		
Percent of 12th- grade public school students in 1998 who used computers to write drafts/final versions of papers	77	0.69
Percent of 12th- grade public school students in 1998 who used computers to practice spelling, punctuation, and grammar	45	0.55
Percent of 12th- grade public school students in 1998 who used computers to write in a log or journal	27	0.68
Chapter 2, section on technology use in schools and classrooms: findings from FRSS		
Percent of public school teachers in 1999 who had computers in their schools	99	0.19
Percent of public school teachers in 1999 who had computers at home	82	1.01

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999; National Assessment of Educational Progress (NAEP), 1994 and 1998 Reading Assessments, 1996 Math Assessments, 1996 Science Assessments, 1992 and 1998 Writing Assessments.

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Table A-3.1a.—Standard errors of the percent of public school teachers reporting computer availability in the classroom and elsewhere in school, by school characteristics: 1999

School characteristics	Computers available in classroom		Computers available elsewhere in school	
	Yes	No	Yes	No
All public school teachers	**1.07**	**1.07**	**0.66**	**0.66**
Instructional level				
Elementary	1.28	1.28	0.96	0.96
Secondary	2.00	2.00	0.42	0.42
Enrollment size				
Less than 300	2.60	2.60	2.83	2.83
300 to 999	1.14	1.14	0.82	0.82
1,000 or more	3.03	3.03	0.88	0.88
Locale				
City	2.43	2.43	1.18	1.18
Urban fringe	1.82	1.82	1.09	1.09
Town	1.70	1.70	2.21	2.21
Rural	2.12	2.12	1.13	1.13
Percent minority enrollment in school				
Less than 6 percent	1.90	1.90	1.46	1.46
6 to 20 percent	2.32	2.32	1.33	1.33
21 to 49 percent	1.69	1.69	1.30	1.30
50 percent or more	2.75	2.75	1.21	1.21

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Table A-3.2a.—Standard errors of the percent of public school teachers reporting varying numbers of computers available in the classroom, by school characteristics: 1999

School characteristics	Number of computers available in the classroom			
	None	One	2-5	More than 5
All public school teachers	**1.09**	**1.51**	**1.49**	**0.85**
Instructional level				
Elementary	1.31	1.95	2.00	1.09
Secondary	1.98	2.16	1.64	1.11
Enrollment size				
Less than 300	2.58	3.59	3.63	2.44
300 to 999	1.14	1.87	1.94	1.03
1,000 or more	3.09	2.99	2.38	1.53
Locale				
City	2.42	2.78	2.87	1.48
Urban fringe	1.87	2.40	2.46	1.37
Town	1.69	3.88	3.82	2.05
Rural	2.12	3.24	3.34	1.86
Percent minority enrollment in school				
Less than 6 percent	2.02	2.65	2.88	1.48
6 to 20 percent	2.30	3.11	3.13	1.72
21 to 49 percent	1.68	3.16	3.06	1.62
50 percent or more	2.75	2.95	3.06	1.66
Percent of students in school eligible for free or reduced-price school lunch				
Less than 11 percent	2.71	3.72	3.77	1.71
11 to 30 percent	2.13	2.68	2.68	1.56
31 to 49 percent	2.42	3.20	3.27	1.73
50 to 70 percent	2.36	4.08	4.17	2.28
71 percent or more	2.90	3.69	4.03	2.28

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Table A-3.3a.—Standard errors of the percent of public school teachers reporting Internet availability in the classroom and elsewhere in school, by school characteristics: 1999

School characteristics	Internet available in classroom		Internet available elsewhere in school	
	Yes	No	Yes	No
All public school teachers	**1.86**	**1.86**	**1.14**	**1.14**
Instructional level				
Elementary	2.38	2.38	1.62	1.62
Secondary	2.38	2.38	0.74	0.74
Enrollment size				
Less than 300	4.57	4.57	2.15	2.15
300 to 999	2.33	2.33	1.45	1.45
1,000 or more	3.38	3.38	2.11	2.11
Locale				
City	3.63	3.63	1.86	1.86
Urban fringe	2.99	2.99	2.21	2.21
Town	4.38	4.38	1.29	1.29
Rural	4.05	4.05	2.26	2.26
Percent minority enrollment in school				
Less than 6 percent	3.50	3.50	2.13	2.13
6 to 20 percent	3.52	3.52	1.96	1.96
21 to 49 percent	3.42	3.42	1.83	1.83
50 percent or more	4.03	4.03	2.70	2.70
Percent of students in school eligible for free or reduced-price school lunch				
Less than 11 percent	4.42	4.42	2.39	2.39
11 to 30 percent	3.32	3.32	1.61	1.61
31 to 49 percent	3.74	3.74	2.22	2.22
50 to 70 percent	4.38	4.38	3.57	3.57
71 percent or more	5.09	5.09	3.61	3.61

NOTE: Teachers who reported that computers were not available to them in the classroom were excluded from the "Internet available in classroom" analyses presented in this table. Teachers who reported that computers were not available to them elsewhere in the school were excluded from the "Internet available elsewhere in school" analyses presented in this table.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

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Table A-3.4a.—Standard errors of the percent of public school teachers reporting varying numbers of computers in the classroom with Internet connections, by school characteristics: 1999

School characteristics	Number of computers in the classroom with Internet			
	None	One	2-5	More than 5
All public school teachers	**1.86**	**1.83**	**1.28**	**0.58**
Instructional level				
Elementary	2.38	2.28	1.62	0.64
Secondary	2.38	2.63	1.53	0.98
Enrollment size				
Less than 300	4.54	4.56	2.93	1.37
300 to 999	2.32	2.24	1.58	0.69
1,000 or more	3.56	3.62	2.26	0.97
Locale				
City	3.64	3.48	2.60	1.05
Urban fringe	3.00	2.97	1.77	0.82
Town	4.36	4.33	3.20	1.19
Rural	3.98	3.82	2.72	1.46
Percent minority enrollment in school				
Less than 6 percent	3.44	3.29	2.68	0.80
6 to 20 percent	3.49	3.70	2.21	1.26
21 to 49 percent	3.47	3.39	2.49	1.19
50 percent or more	4.05	3.85	2.22	0.84
Percent of students in school eligible for free or reduced-price school lunch				
Less than 11 percent	4.31	4.60	2.89	1.36
11 to 30 percent	3.29	3.32	2.52	0.87
31 to 49 percent	3.69	3.97	3.13	1.44
50 to 70 percent	4.40	4.04	2.63	1.56
71 percent or more	5.09	4.82	2.42	1.19

NOTE: Teachers who reported that computers were not available to them in the classroom were excluded from the analyses presented in this table.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Table A-3.5a.—Standard errors of the percent of public school teachers having e-mail available to them at school, by school characteristics: 1999

School characteristics	E-mail available at school	
	Yes	No
All public school teachers	**1.47**	**1.47**
Locale		
City	2.68	2.68
Urban fringe	2.58	2.58
Town	3.21	3.21
Rural	2.74	2.74
Percent minority enrollment in school		
Less than 6 percent	2.58	2.58
6 to 20 percent	2.77	2.77
21 to 49 percent	2.77	2.77
50 percent or more	3.16	3.16
Percent of students in school eligible for free or reduced-price school lunch		
Less than 11 percent	3.28	3.28
11 to 30 percent	2.47	2.47
31 to 49 percent	2.98	2.98
50 to 70 percent	3.96	3.96
71 percent or more	4.02	4.02

NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the analyses presented in this table.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Table A-3.6a.—Standard errors of the percent of public school teachers having computers and the Internet available to them at home, and the percent of teachers having a school network that they can access from home, by school characteristics: 1999

School characteristics	Computer available at home		Internet available at home		School network accessible from home	
	Yes	No	Yes	No	Yes	No
All public school teachers	**1.01**	**1.01**	**1.30**	**1.30**	**1.21**	**1.21**
Enrollment size						
Less than 300	3.53	3.53	3.67	3.67	2.96	2.96
300 to 999	1.28	1.28	1.67	1.67	1.59	1.59
1,000 or more	1.68	1.68	2.42	2.42	2.20	2.20
Locale						
City	2.03	2.03	2.49	2.49	2.07	2.07
Urban fringe	1.45	1.45	2.06	2.06	2.13	2.13
Town	2.48	2.48	3.40	3.40	3.35	3.35
Rural	2.53	2.53	2.89	2.89	2.24	2.44
Percent of students in school eligible for free or reduced-price school lunch						
Less than 11 percent	2.52	2.52	3.29	3.29	3.65	3.65
11 to 30 percent	1.62	1.62	2.20	2.20	2.14	2.14
31 to 49 percent	2.12	2.12	3.24	3.24	2.63	2.63
50 to 70 percent	2.83	2.83	3.55	3.55	3.04	3.04
71 percent or more	3.02	3.02	3.24	3.24	2.90	2.90

NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the "School network accessible from home" analyses presented in this table.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Table A-3.7a.—Standard errors of the percent of public school teachers reporting that more than 50 percent of their students have computers at home, by school characteristics: 1999

School characteristics	Percent of teachers reporting >50% of students have computers at home
All public school teachers	**1.54**
Enrollment size	
Less than 300	3.99
300 to 999	1.98
1,000 or more	2.98
Locale	
City	2.71
Urban fringe	2.56
Town	3.70
Rural	3.24
Percent minority enrollment in school	
Less than 6 percent	2.76
6 to 20 percent	3.24
21 to 49 percent	2.93
50 percent or more	1.95
Percent of students in school eligible for free or reduced-price school lunch	
Less than 11 percent	3.80
11 to 30 percent	2.51
31 to 49 percent	3.20
50 to 70 percent	3.15
71 percent or more	0.83

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Table A-3.8a.—Standard errors of the percent of public school teachers by number of computers available in classroom who report assignment of various activities to a small, moderate, or large extent, or not at all: 1999

Activities	Number of computers available in the classroom		
	One	2-5	More than 5
All public school teachers	**1.47**	**1.45**	**0.81**
Solve problems/analyze data			
Not at all	2.30	2.25	3.45
Small extent	1.93	1.95	4.05
Moderate extent	1.71	1.99	3.82
Large extent	0.98	1.31	3.43
Word processing/spreadsheets			
Not at all	2.34	2.10	2.87
Small extent	1.67	1.91	3.51
Moderate extent	1.86	1.93	3.60
Large extent	1.57	1.85	4.05
Drills/practice			
Not at all	2.18	2.23	3.23
Small extent	1.81	1.88	3.43
Moderate extent	1.56	1.95	3.75
Large extent	0.98	1.76	4.06

NOTE: Teachers who reported that computers were not available them in the classroom were excluded from the analyses presented in this table.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Table A-3.9.—Standard errors for the figures and for data not shown in tables in chapter 3: FRSS 1999; NAEP 1990, 1994, 1998; CPS 1994, 1997, 1998

Item	Estimate	Standard error
Figure 3.1: Percent of public school 4th-, 8th-, and 12th-grade students who had school administrators reporting varying numbers of computers at the school: 1990 and 1998		
4th-grade: 1990: 76 or more computers	1	0.54
4th-grade: 1990: 51 to 75 computers	3	1.13
4th-grade: 1990: 26 to 50 computers	28	3.05
4th-grade: 1990: 1 to 25 computers	60	3.28
4th-grade: 1990: none available	7	1.79
4th-grade: 1998: 76 or more computers	33	2.99
4th-grade: 1998: 51 to 75 computers	20	1.89
4th-grade: 1998: 26 to 50 computers	31	2.74
4th-grade: 1998: 1 to 25 computers	16	2.44
4th-grade: 1998: none available	0	0.00
8th-grade: 1990: 76 or more computers	8	3.55
8th-grade: 1990: 51 to 75 computers	13	2.97
8th-grade: 1990: 26 to 50 computers	36	4.11
8th-grade: 1990: 1 to 25 computers	40	3.75
8th-grade: 1990: none available	3	1.33
8th-grade: 1998: 76 or more computers	51	3.49
8th-grade: 1998: 51 to 75 computers	20	2.77
8th-grade: 1998: 26 to 50 computers	22	2.73
8th-grade: 1998: 1 to 25 computers	7	1.51
8th-grade: 1998: none available	0	0.00
12th-grade: 1990: 76 or more computers	42	4.27
12th-grade: 1990: 51 to 75 computers	21	3.87
12th-grade: 1990: 26 to 50 computers	27	4.01
12th-grade: 1990: 1 to 25 computers	11	2.15
12th-grade: 1990: none available	0	0.35
12th-grade: 1998: 76 or more computers	73	2.49
12th-grade: 1998: 51 to 75 computers	13	2.30
12th-grade: 1998: 26 to 50 computers	11	1.74
12th-grade: 1998: 1 to 25 computers	3	1.03
12th-grade: 1998: none available	0	0.00
Figure 3.2: Percent of public school 4th-, 8th-, and 12th-grade students who had school administrators reporting computer labs at school, computers in the classroom, or computers available to bring to class: 1998		
Computer labs at school: 4th-grade	78	2.35
Computer labs at school: 8th-grade	90	1.60
Computer labs at school: 12th-grade	94	1.58
Always have computers in the classroom: 4th-grade	83	2.10
Always have computers in the classroom: 8th-grade	46	3.40
Always have computers in the classroom: 12th-grade	27	2.90
Computers available to bring to class: 4th-grade	39	3.52
Computers available to bring to class: 8th-grade	42	2.48
Computers available to bring to class: 12th-grade	40	3.57
Figure 3.3: Percent of public school 4th- and 8th- grade students having teachers reporting computers available in their classes or labs as their best computer availability: 1998		
1998: available in class: 4th-grade	72	2.22
1998: available in class: 8th-grade	49	2.60
1998: available in lab: 4th-grade	23	2.06
1998: available in lab: 8th-grade	42	2.39
Figure 3.5: Ratio of students per instructional computer and students per instructional computer with Internet access, by school characteristics: 1999		
Ratio of students per instructional computers:		
All public schools	6	102.6
Enrollment size: less than 300	4	191.2

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Table A-3.9.—Standard errors for the figures and for data not shown in tables in chapter 3: FRSS 1999; NAEP 1990, 1994, 1998; CPS 1994, 1997, 1998—Continued

Item	Estimate	Standard error
Enrollment size: 300 to 999	6	128.0
Enrollment size: 1,000 or more	6	282.9
Locale: city	6	235.2
Locale: urban fringe	6	193.7
Locale: town	6	224.3
Locale: rural	4	182.4
Percent minority enrollment in school: less than 6 percent	5	154.5
Percent minority enrollment in school: 6 to 20 percent	5	221.4
Percent minority enrollment in school: 21 to 49 percent	6	213.2
Percent minority enrollment in school: 50 percent or more	6	273.8
Percent of students in school eligible for free or reduced-price lunch: less than 11 percent	5	206.7
Percent of students in school eligible for free or reduced-price lunch: 11 to 30 percent	5	213.1
Percent of students in school eligible for free or reduced-price lunch: 31 to 49 percent	6	272.8
Percent of students in school eligible for free or reduced-price lunch: 50 to 70 percent	6	312.8
Percent of students in school eligible for free or reduced-price lunch: 71 percent or more	6	328.3
Ratio of students per instructional computers with Internet access:		
All public schools	8	287.2
Enrollment size: less than 300	8	411.7
Enrollment size: 300 to 999	8	403.5
Enrollment size: 1,000 or more	10	550.6
Locale: city	11	756.8
Locale: urban fringe	8	415.7
Locale: town	8	583.1
Locale: rural	7	434.8
Percent minority enrollment in school: less than 6 percent	7	320.8
Percent minority enrollment in school: 6 to 20 percent	8	462.4
Percent minority enrollment in school: 21 to 49 percent	9	724.2
Percent minority enrollment in school: 50 percent or more	13	1084.3
Percent of students in school eligible for free or reduced-price lunch: less than 11 percent	7	478.0
Percent of students in school eligible for free or reduced-price lunch: 11 to 30 percent	8	458.3
Percent of students in school eligible for free or reduced-price lunch: 31 to 49 percent	9	392.4
Percent of students in school eligible for free or reduced-price lunch: 50 to 70 percent	10	803.9
Percent of students in school eligible for free or reduced-price lunch: 71 percent or more	16	2046.3
Figure 3.7: Percent of elementary and secondary teachers and adults in other occupations who report having computers at home: 1994, 1997, and 1998		
1994: teachers	54	1.43
1994: adults in other occupations	28	0.17
1997: teachers	66	1.38
1997: adults in other occupations	40	0.18
1998: teachers	74	1.25
1998: adults in other occupations	46	0.19
Figure 3.8: Percent of public school teachers having varying numbers of computers connected to the Internet when there are computers in the classroom: 1999		
Computers connected to the Internet: none	37	1.82
Computers connected to the Internet: one	46	1.76
Computers connected to the Internet: 2-5	13	1.23
Computers connected to the Internet: more than 5	4	0.54
Figure 3.9: Percent of public school teachers who report using computers or the Internet a little or a lot for various activities, by number of classroom computers: 1999		
Create instructional materials: one: a little	38	2.03
Create instructional materials: one: a lot	41	2.08
Create instructional materials: one: to any extent	79	1.78
Create instructional materials: 2-5: a little	41	2.13
Create instructional materials: 2-5: a lot	45	2.29
Create instructional materials: 2-5: to any extent	86	1.6

Table A-3.9.—Standard errors for the figures and for data not shown in tables in chapter 3: FRSS 1999; NAEP 1990, 1994, 1998; CPS 1994, 1997, 1998—Continued

Item	Estimate	Standard error
Create instructional materials: more than 5: a little	36	4.00
Create instructional materials: more than 5: a lot	52	4.26
Create instructional materials: more than 5: to any extent	88	2.72
Gather information for lesson plans: one: a little	46	2.22
Gather information for lesson plans: one: a lot	13	1.33
Gather information for lesson plans: one: to any extent	59	2.29
Gather information for lesson plans: 2-5: a little	48	2.14
Gather information for lesson plans: 2-5: a lot	17	1.55
Gather information for lesson plans: 2-5: to any extent	65	2.06
Gather information for lesson plans: more than 5: a little	41	4.27
Gather information for lesson plans: more than 5: a lot	28	3.86
Gather information for lesson plans: more than 5: to any extent	69	4.26
Administrative record keeping: one: a little	17	1.57
Administrative record keeping: one: a lot	37	2.12
Administrative record keeping: one: to any extent	54	2.32
Administrative record keeping: 2-5: a little	17	1.76
Administrative record keeping: 2-5: a lot	36	2.29
Administrative record keeping: 2-5: to any extent	53	2.34
Administrative record keeping: more than 5: a little	16	3.23
Administrative record keeping: more than 5: a lot	47	4.28
Administrative record keeping: more than 5: to any extent	63	4.26
Access research and best practice examples: one: a little	11	2.08
Access research and best practice examples: one: a lot	2	1.01
Access research and best practice examples: one: to any extent	38	2.23
Access research and best practice examples: 2-5: a little	30	2.03
Access research and best practice examples: 2-5: a lot	9	1.17
Access research and best practice examples: 2-5: to any extent	39	2.17
Access research and best practice examples: more than 5: a little	45	4.27
Access research and best practice examples: more than 5: a lot	10	2.35
Access research and best practice examples: more than 5: to any extent	55	4.35
Multimedia presentations: one: a little	27	1.85
Multimedia presentations: one: a lot	6	0.97
Multimedia presentations: one: to any extent	33	2.03
Multimedia presentations: 2-5: a little	34	2.02
Multimedia presentations: 2-5: a lot	8	1.24
Multimedia presentations: 2-5: to any extent	43	2.23
Multimedia presentations: more than 5: a little	36	4.04
Multimedia presentations: more than 5: a lot	21	3.57
Multimedia presentations: more than 5: to any extent	57	4.21
Access model lesson plans: one: a little	27	2.02
Access model lesson plans: one: a lot	6	0.95
Access model lesson plans: one: to any extent	33	2.15
Access model lesson plans: 2-5: a little	30	2.03
Access model lesson plans: 2-5: a lot	8	1.16
Access model lesson plans: 2-5: to any extent	38	2.16
Access model lesson plans: more than 5: a little	38	4.29
Access model lesson plans: more than 5: a lot	8	2.17
Access model lesson plans: more than 5: to any extent	48	4.33

Table A-3.9.—Standard errors for the figures and for data not shown in tables in chapter 3: FRSS 1998; NAEP 1990, 1994, 1998; CPS 1994, 1997, 1998—Continued

Item	Estimate	Standard error
Chapter 3, section on teachers' reports of computer availability to students		
Percent of 4th grade public school students who have teachers reporting computers are not available as their best computer availability	5	1.01
Percent of 4th grade public school students who have teachers reporting computers are available in lab or library but difficult to access as their best computer availability	12	1.71
Percent of 4th grade public school students who have teachers reporting computers are readily available in lab or library as their best computer availability	14	1.61
Percent of 4th grade public school students who have teachers reporting one computer in class as their best computer availability	30	2.26
Percent of 4th grade public school students who have teachers reporting several computers in class as their best computer availability	39	2.61
Percent of 8th grade public school students who have teachers reporting computers are not available as their best computer availability	11	1.76
Percent of 8th grade public school students who have teachers reporting computers are available in lab or library but difficult to access as their best computer availability	31	2.68
Percent of 8th grade public school students who have teachers reporting computers are readily available in lab or library as their best computer availability	22	2.20
Percent of 8th grade public school students who have teachers reporting one computer in class as their best computer availability	26	2.13
Percent of 8th grade public school students who have teachers reporting several computers in class as their best computer availability	15	1.58
Chapter 3, section on teachers' computer availability at home		
Percent of teachers in 1998 who had one computer at home	71	1.50
Percent of teachers in 1998 who had two computers at home	20	1.33
Percent of teachers in 1998 who had three or more computers at home	9	0.93
Percent of adults in other occupations in 1998 who had one computer at home	75	0.24
Percent of adults in other occupations in 1998 who had two computers at home	18	0.21
Percent of adults in other occupations in 1998 who had three or more computers at home	7	0.14
Percent of teachers in 1998 who had computers that were three years old or newer	71	2.48
Percent of adults in other occupations in 1998 who had computers that were three years old or newer	75	0.38
Chapter 3, section on students' computer availability at home		
Percent of students in 1994 who had at least one computer at home	36	0.34
Percent of students in 1998 who had at least one computer at home	56	0.36
Chapter 3, section on computer availability in the school		
Percent of public school teachers in 1998 who had computers available somewhere in their schools	89	0.18

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1998; National Assessment of Educational Progress (NAEP), 1990, 1994, and 1998 Reading Assessments, 1990 Math Assessments; U.S. Census Bureau, Current Population Survey, November 1994, October 1997, December 1998.

Table A-4.1a.—Standard errors of the percent of public school teachers reporting using e-mail at school to a large extent when available, by school characteristics: 1999

School characteristics	E-mail used
All public school teachers	1.84
Locale	
City	3.08
Urban fringe	2.91
Town	3.93
Rural	3.42
Percent minority enrollment in school	
Less than 6 percent	3.06
6 to 20 percent	3.58
21 to 49 percent	3.11
50 percent or more	3.32
Percent of students in school eligible for free or reduced-price school lunch	
Less than 11 percent	4.08
11 to 30 percent	3.17
31 to 49 percent	3.56
50 to 70 percent	3.91
71 percent or more	4.04

NOTE: Teachers who reported that e-mail was not available to them anywhere in the school were excluded from the analyses presented in this table.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999

Table A-4.2a.—Standard errors of the percent of public school teachers reporting student use of the Internet in the classroom, computer labs, media centers, or libraries to any extent during class time, by school characteristics: 1999

School characteristics	Internet used
All public school teachers	**1.44**
Locale	
City	2.85
Urban fringe	2.37
Town	3.28
Rural	3.25
Percent minority enrollment in school	
Less than 6 percent	2.63
6 to 20 percent	2.84
21 to 49 percent	2.97
50 percent or more	3.03
Percent of students in school eligible for free or reduced-price school lunch	
Less than 11 percent	3.57
11 to 30 percent	2.76
31 to 49 percent	2.88
50 to 70 percent	3.66
71 percent or more	3.60

NOTE: Teachers who reported that the Internet was not available to them anywhere in the school were excluded from the analyses presented in this table.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Table A-4.3.—Standard errors for the figures and for data not shown in tables in chapter 4: FRSS 1999; NAEP 1992, 1994, 1996, and 1998; CPS 1997 and 1998

Item	Estimate	Standard error
Figure 4.1: Percent of elementary and secondary teachers reporting use of the Internet at work: 1997 and 1998		
Elementary teachers: 1997	23	1.68
Elementary teachers: 1998	33	1.79
Secondary teachers: 1997	28	2.24
Secondary teachers: 1998	43	2.38
Figure 4.2: Percent of public school teachers reporting use of computers, the Internet, and e-mail at school to any extent when available: 1999		
Computers: to any extent	99	0.23
Internet: to any extent	96	0.59
E-mail: to any extent	77	1.41
Figure 4.3: Percent of public school teachers reporting frequency of use of various technologies to a small, moderate, or large extent: 1999		
Computers in classroom: small extent	25	1.28
Computers in classroom: moderate extent	34	1.41
Computers in classroom: large extent	39	1.50
Computers in classroom: to any extent	98	0.46
Computers elsewhere in school: small extent	37	1.32
Computers elsewhere in school: moderate extent	31	1.30
Computers elsewhere in school: large extent	18	1.03
Computers elsewhere in school: to any extent	85	0.99
Internet in classroom: small extent	37	1.74
Internet in classroom: moderate extent	30	1.63
Internet in classroom: large extent	20	1.43
Internet in classroom: to any extent	88	1.17
Internet elsewhere in school: small extent	41	1.39
Internet elsewhere in school: moderate extent	20	1.12
Internet elsewhere in school: large extent	10	0.83
Internet elsewhere in school: to any extent	70	1.42
E-mail in school: small extent	25	1.40
E-mail in school: moderate extent	18	1.20
E-mail in school: large extent	34	1.64
E-mail in school: to any extent	77	1.41
Figure 4.4: Percent of public school teachers reporting use of computers or the Internet in the classroom to a large extent, by numbers of computers and computers with Internet connections in the classroom: 1999		
Number of computers available in classroom: one	28	1.94
Number of computers available in classroom: 2-5	43	2.15
Number of computers available in classroom: more than 5	62	4.21
Number of computers with Internet connections available in classroom: one	18	1.57
Number of computers with Internet connections available in classroom: 2-5	22	3.21
Number of computers with Internet connections available in classroom: more than 5	45	7.07
Figure 4.5: Percent of public school teachers reporting use of computers or the Internet elsewhere in the school to a large extent, by numbers of computers and computers with Internet connections in the classroom: 1999		
Number of computers available in classroom for instruction: none	10	1.28
Number of computers available in classroom for instruction: one	20	1.83
Number of computers available in classroom for instruction: 2-5	23	2.29
Number of computers available in classroom for instruction: more than 5	23	4.08
Number of computers with Internet connections available in classroom: none	7	1.02
Number of computers with Internet connections available in classroom: one	12	1.37
Number of computers with Internet connections available in classroom: 2-5	12	2.89
Number of computers with Internet connections available in classroom: more than 5	24	5.91

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Table A-4.3.—Standard errors for the figures and for data not shown in tables in chapter 4: FRSS 1999; NAEP 1992, 1994, 1996, and 1998; CPS 1997 and 1998—Continued

Item	Estimate	Standard error
Figure 4.6: Percent of public school teachers reporting use of computers, e-mail, and the Internet at school to a large extent, by years of teaching experience: 1999		
Computers at school: 3 or fewer years	48	3.72
Computers at school: 4 to 9 years	45	2.91
Computers at school: 10 to 19 years	41	2.72
Computers at school: 20 or more years	33	2.01
E-mail at school: 3 or fewer years	48	4.55
E-mail at school: 4 to 9 years	35	3.41
E-mail at school: 10 to 19 years	37	2.97
E-mail at school: 20 or more years	26	2.24
Internet at school: 3 or fewer years	28	3.35
Internet at school: 4 to 9 years	21	2.54
Internet at school: 10 to 19 years	17	1.96
Internet at school: 20 or more years	13	1.38
Figure 4.7: Percent of employed adults in the United States reporting use of computers at work, by various occupations: 1997		
Librarians	95	2.51
Editors and reporters	88	3.33
College and university teachers	80	2.25
Real estate/sales occupations	79	2.56
Lawyers and judges	78	2.28
Secondary teachers	69	2.31
Elementary teachers	67	1.86
Physicians	62	3.17
Clergy	62	4.48
All other occupations	48	0.25
Teachers' aides	40	3.25
Figure 4.8: Percent of public school teachers reporting student use of various technologies in schools and classrooms: 1999		
Computer in a computer lab or library/media center: rarely	13	0.92
Computer in a computer lab or library/media center: sometimes	37	1.28
Computer in a computer lab or library/media center: often	28	1.27
Computer in a computer lab or library/media center: to any extent	78	1.16
Computers in the classroom: rarely	14	0.93
Computers in the classroom: sometimes	29	1.24
Computers in the classroom: often	26	1.31
Computers in the classroom: to any extent	69	1.31
Internet in a computer lab or library/media center: rarely	20	1.06
Internet in a computer lab or library/media center: sometimes	27	1.18
Internet in a computer lab or library/media center: often	9	0.75
Internet in a computer lab or library/media center: to any extent	55	1.46
Internet in the classroom: rarely	14	0.94
Internet in the classroom: sometimes	14	0.99
Internet in the classroom: often	6	0.59
Internet in the classroom: to any extent	34	1.47
Distance learning via the Internet: rarely	10	0.77
Distance learning via the Internet: sometimes	5	0.55
Distance learning via the Internet: often	1	0.28
Distance learning via the Internet: to any extent	16	0.97
Distance learning via other modes of interactive media: rarely	10	0.80
Distance learning via other modes of interactive media: sometimes	5	0.54
Distance learning via other modes of interactive media: often	1	0.33
Distance learning via other modes of interactive media: to any extent	16	0.98

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Table A-4.3.—Standard errors for the figures and for data not shown in tables in chapter 4: FRSS 1999; NAEP 1992, 1994, 1996, and 1998; CPS 1997 and 1998—Continued

Item	Estimate	Standard error
Figure 4.9: Percent of public school teachers reporting student use of computers or the Internet in the classroom often, by number of computers and number of computers with Internet connections in the classroom: 1999		
Number of computers available in classroom: one	13	1.53
Number of computers available in classroom: 2-5	41	2.31
Number of computers available in classroom: more than 5	61	4.40
Number of computers with Internet connections available in classroom: one	6	1.02
Number of computers with Internet connections available in classroom: 2-5	18	2.73
Number of computers with Internet connections available in classroom: more than 5	33	6.66
Figure 4.10: Percent of public school teachers reporting student use of computers or the Internet elsewhere in the school often, by number of computers for instruction and number of computers with Internet connections in the classroom: 1999		
Number of computers available in classroom for instruction: none	17	1.66
Number of computers available in classroom for instruction: one	34	2.18
Number of computers available in classroom for instruction: 2-5	33	2.72
Number of computers available in classroom for instruction: more than 5	34	4.56
Number of computers with Internet connections available in classroom: none	5	0.81
Number of computers with Internet connections available in classroom: one	11	1.28
Number of computers with Internet connections available in classroom: 2-5	12	2.54
Number of computers with Internet connections available in classroom: more than 5	29	6.13
Figure 4.11: Percent of public school teachers reporting student use of computers and the Internet at school to any extent, by instructional level: 1999		
Students' use of computers at school: elementary teachers	92	0.98
Students' use of computers at school: secondary teachers	80	1.54
Students' use of Internet at school: elementary teachers	56	1.96
Students' use of Internet at school: secondary teachers	72	1.72
Figure 4.12: Percent of employed U.S. elementary teachers, secondary teachers, and adults in other occupations reporting use of computers and the Internet at home to any extent when computers are available in the household: 1997 and 1998		
Computer use at home when available: 1997: adults in other occupations	74	0.31
Computer use at home when available: 1997: elementary teachers	83	1.82
Computer use at home when available: 1997: secondary teachers	89	1.94
Internet use at home: 1997: adults in other occupations	37	0.24
Internet use at home: 1997: elementary teachers	35	1.89
Internet use at home: 1997: secondary teachers	44	2.50
Internet use at home: 1998: adults in other occupations	51	0.33
Internet use at home: 1998: elementary teachers	57	2.19
Internet use at home: 1998: secondary teachers	60	2.75
Figure 4.13: Percent of public school teachers reporting use of computers and the Internet at home to a large extent, by years of teaching experience: 1999		
Teacher used computer at home: 3 or fewer years	65	3.98
Teacher used computer at home: 4 to 9 years	57	3.11
Teacher used computer at home: 10 to 19 years	46	2.85
Teacher used computer at home: 20 or more years	39	2.16
Teacher used Internet at home: 3 or fewer years	62	4.79
Teacher used Internet at home: 4 to 9 years	55	3.62
Teacher used Internet at home: 10 to 19 years	35	3.05
Teacher used Internet at home: 20 or more years	36	2.51

Table A-4.3.—Standard errors for the figures and for data not shown in tables in chapter 4: FRSS 1999; NAEP 1992, 1994, 1996, and 1998; CPS 1997 and 1998—Continued

Item	Estimate	Standard error
Figure 4.14: Percent of public school teachers reporting technology use in school to a large extent for instruction and student assignment, by their use of computers and the Internet at home: 1999		
Used computers at home: used computers for instruction	54	1.91
Used computers at home: did not use computers for instruction	43	2.14
Used computers at home: assigned projects requiring students to use computers	52	1.58
Used computers at home: did not assign projects requiring students to use computers	37	3.03
Used Internet at home: used computers for instruction	49	2.15
Used Internet at home: did not use computers for instruction	36	2.45
Used Internet at home: assigned projects requiring students to use computers	46	1.81
Used Internet at home: did not assign projects requiring students to use computers	35	3.57
Figure 4.15: Percent of public school 4th -, 8th -, and 12th- grade students reporting using a computer at home at least once a week, once or twice a month, or never or hardly ever: 1992, 1994, and 1998		
4th-grade: 1992: almost every day	7	0.64
4th-grade: 1992: once or twice a week	17	1.06
4th-grade: 1992: once or twice a month	8	0.57
4th-grade: 1992: never or hardly ever	68	1.33
4th-grade: 1994: almost every day	10	0.83
4th-grade: 1994: once or twice a week	20	1.12
4th-grade: 1994: once or twice a month	10	0.58
4th-grade: 1994: never or hardly ever	60	1.49
4th-grade: 1998: almost every day	9	0.72
4th-grade: 1998: once or twice a week	20	0.83
4th-grade: 1998: once or twice a month	17	0.65
4th-grade: 1998: never or hardly ever	55	1.22
8th-grade: 1992: almost every day	8	0.50
8th-grade: 1992: once or twice a week	13	0.55
8th-grade: 1992: once or twice a month	19	0.61
8th-grade: 1992: never or hardly ever	60	1.07
8th-grade: 1994: almost every day	9	0.52
8th-grade: 1994: once or twice a week	15	0.61
8th-grade: 1994: once or twice a month	22	0.65
8th-grade: 1994: never or hardly ever	53	1.08
8th-grade: 1998: almost every day	14	0.72
8th-grade: 1998: once or twice a week	23	0.73
8th-grade: 1998: once or twice a month	28	0.69
8th-grade: 1998: never or hardly ever	34	0.97
12th-grade: 1992: almost every day	17	0.63
12th-grade: 1992: once or twice a week	12	0.40
12th-grade: 1992: once or twice a month	21	0.60
12th-grade: 1992: never or hardly ever	50	0.79
12th-grade: 1994: almost every day	18	0.62
12th-grade: 1994: once or twice a week	17	0.53
12th-grade: 1994: once or twice a month	25	0.56
12th-grade: 1994: never or hardly ever	40	1.02
12th-grade: 1998: almost every day	21	0.63
12th-grade: 1998: once or twice a week	27	0.64
12th-grade: 1998: once or twice a month	30	0.57
12th-grade: 1998: never or hardly ever	23	0.85
Chapter 4, section on overall technology use		
Percent of public school teachers in 1999 who reported that their students used computers either in the classroom or in computer labs, libraries, and media centers	88	0.81
Percent of public school teachers in 1999 who reported that their students used the Internet in the classroom or somewhere else in the school	61	1.43

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Table A-4.3.—Standard errors for the figures and for data not shown in tables in chapter 4: FRSS 1999; NAEP 1992, 1994, 1996, and 1998; CPS 1997 and 1998—Continued

Item	Estimate	Standard error
Chapter 4, section on teacher access to computers and the Internet at home		
Percent of public school teachers in 1999 who used home computers to any extent when available	98	0.38
Percent of public school teachers in 1999 who used home computers to a large extent when available	48	1.43
Percent of public school teachers in 1999 who used the Internet at home to any extent when available	97	0.52
Percent of public school teachers in 1999 who used the Internet at home to a large extent when available	43	1.61
Percent of public school teachers in 1999 who used a school network from home when available	56	2.55

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999; National Assessment of Educational Progress (NAEP), 1992 and 1996 Math Assessments, 1992, 1994, and 1998 Reading Assessments; U.S. Census Bureau, Current Population Survey (CPS): October 1997, and December 1998.

Table 5.1a.—Standard errors of the percent of public school teachers reporting using computers or the Internet for various activities at school to any extent, by extent to which they felt prepared to use computers and the Internet for instruction: 1999

Teachers' feelings of preparedness	Activities				
	Create instructional materials	Gather information for lesson plans	Access model lesson plans	Access research and best practice examples	Multimedia presentations
All public school teachers	**1.13**	**1.41**	**1.30**	**1.34**	**1.35**
Not at all	3.56	3.06	2.29	2.07	2.27
Somewhat	1.51	1.88	1.77	1.71	1.75
Well/very well	1.76	2.21	2.32	2.38	2.41

Table 5.1a.—Standard errors of the percent of public school teachers reporting using computers or the Internet for various activities at school to any extent, by extent to which they felt prepared to use computers and the Internet for instruction: 1999—Continued

Teachers' feelings of preparedness	Activities				
	Administrative record keeping	Communicate with colleagues	Communicate with parents	Communicate with students	Post homework/ assignments
All public school teachers	**1.48**	**1.70**	**1.35**	**0.84**	**0.99**
Not at all	3.29	3.60	2.05	1.37	2.09
Somewhat	1.89	2.06	1.69	1.13	1.38
Well/very well	2.39	2.58	2.27	1.66	1.81

NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the analyses presented in this table.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

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Table A-5.2a.—Standard errors of the percent of public school teachers reporting assigning students various activities to any extent that use computers or the Internet, by extent to which they felt prepared to use computers and the Internet for instruction: 1999

Teachers' feelings of preparedness	Activities			
	Practice drills	Solve problems/ analyze data	Word processing/ spreadsheets	Graphical presentations
All public school teachers	**1.40**	**1.41**	**1.40**	**1.48**
Not at all	3.41	2.69	3.41	2.91
Somewhat	1.84	2.02	1.90	1.91
Well/very well	2.44	2.25	1.87	2.33

Table A-5.2a.—Standard errors of the percent of public school teachers reporting assigning students various activities to any extent that use computers or the Internet, by extent to which they felt prepared to use computers and the Internet for instruction: 1999—Continued

Teachers' feelings of preparedness	Activities			
	Demonstrations /simulations	Multimedia projects	CD-ROM research	Internet research
All public school teachers	**1.47**	**1.51**	**1.51**	**1.51**
Not at all	2.66	3.22	2.93	3.14
Somewhat	1.86	1.92	1.95	1.93
Well/very well	2.35	2.32	2.37	2.38

NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the analyses presented in this table.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Table A-5.3a.—Standard errors of the percent of public school teachers reporting participation in available training programs, by years of teaching experience: 1999

Training programs	Years of teaching experience			
	3 or fewer	4-9	10-19	20 or more
Computer use/basic computer training	3.73	2.50	1.79	1.24
Software applications	3.97	2.64	2.03	1.65
Use of the Internet	3.84	2.79	2.44	1.85
Use of other advanced telecommunications (e.g., interactive audio, video, closed-circuit TV)	5.37	4.77	3.88	3.32
Integration of technology into the curriculum/ classroom instruction	4.16	3.14	2.58	2.28
Follow-up and/or advanced training	4.51	3.91	3.54	2.80

NOTE: Teachers reporting not having the above listed training programs available were excluded from the analyses presented in this table.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Table A-5.4a.—Standard errors of the percent of public school teachers reporting feeling prepared to various extents to use computers and the Internet for instruction, by hours spent in professional development: 1999

Hours of professional development	Teachers' feelings of preparedness		
	Not at all	Somewhat	Well/very well
All public school teachers	**0.89**	**1.29**	**1.31**
0 hours	3.83	4.04	3.28
1-8 hours	1.44	1.87	1.73
9-32 hours	0.91	2.21	2.18
More than 32 hours	0.88	3.45	3.50

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Table A-5.5.—Standard errors for the figures and for data not shown in tables in chapter 5: FRSS 1999

Item	Estimate	Standard error
Figure 5.1: Percent of public school teachers who reporting feeling not at all, somewhat, or well/very well prepared to use computers and the Internet for classroom instruction, by years of teaching experience: 1999		
3 or fewer years: not at all prepared	16	2.08
3 or fewer years: somewhat prepared	45	3.56
3 or fewer years: well/very well prepared	45	3.80
4 to 9 years: not at all prepared	10	1.71
4 to 9 years: somewhat prepared	49	2.87
4 to 9 years: well/very well prepared	41	2.89
10 to 19 years: not at all prepared	14	1.82
10 to 19 years: somewhat prepared	55	2.65
10 to 19 years: well/very well prepared	31	2.51
20 or more years: not at all prepared	16	1.45
20 or more years: somewhat prepared	57	2.05
20 or more years: well/very well prepared	27	1.86
Figure 5.2: Percent of public school teachers reporting feeling prepared to use computers and the Internet to a small, moderate, or large extent, by various sources of training: 1999		
Independent learning: small extent	23	1.08
Independent learning: moderate extent	31	1.26
Independent learning: large extent	39	1.29
Independent learning: any extent	93	0.71
Professional development activities: small extent	36	1.27
Professional development activities: moderate extent	34	1.24
Professional development activities: large extent	18	1.09
Professional development activities: any extent	88	0.86
Colleagues: small extent	36	1.30
Colleagues: moderate extent	35	1.24
Colleagues: large extent	16	0.99
Colleagues: any extent	87	0.98
Students: small extent	36	1.27
Students: moderate extent	14	0.90
Students: large extent	4	0.47
Students: any extent	54	1.40
College/graduate work: small extent	26	1.21
College/graduate work: moderate extent	15	0.96
College/graduate work: large extent	10	0.79
College/graduate work: any extent	51	1.32
Figure 5.3: Percent of public school teachers reporting whether college/graduate work prepared them not at all or to any extent to use computers and the Internet, by years of teaching experience: 1999		
3 or fewer years: not at all	16	2.50
3 or fewer years: to any extent	84	2.50
4 to 9 years: not at all	24	2.34
4 to 9 years: to any extent	76	2.34
10 to 19 years: not at all	56	2.53
10 to 19 years: to any extent	44	2.53
20 or more years: not at all	69	1.94
20 or more years: to any extent	31	1.94
Figure 5.4: Percent of public school teachers reporting the availability of professional development training activities for various uses and applications of technology: 1999		
Use of computers/basic computer training	96	0.50
Software application	88	0.87
Use of the Internet	87	0.91
Integration of technology into the curriculum/classroom instruction	79	1.13

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Table A-5.5.—Standard errors for the figures and for data not shown in tables in chapter 5: FRSS 1999—Continued

Item	Estimate	Standard error
Follow-up and/or advanced training	67	1.36
Use of other advanced telecommunications	54	1.48
Figure 5.5: Percent of public school teachers reporting the availability of training in the use of the Internet, by percent minority enrollment in school and percent of students in school eligible for free or reduced-price school lunch: 1999		
Percent minority enrollment in school: less than 6 percent	87	1.71
Percent minority enrollment in school: 6 to 20 percent	91	1.67
Percent minority enrollment in school: 21 to 49 percent	90	1.61
Percent minority enrollment in school: 50 percent or more	81	2.25
Percent of students in school eligible for free or reduced-price lunch: less than 11 percent	94	1.65
Percent of students in school eligible for free or reduced-price lunch: 11 to 30 percent	90	1.53
Percent of students in school eligible for free or reduced-price lunch: 31 to 49 percent	91	1.68
Percent of students in school eligible for free or reduced-price lunch: 50 to 70 percent	80	2.82
Percent of students in school eligible for free or reduced-price lunch: 71 percent or more	79	3.09
Figure 5.6: Percent of public school teachers reporting participating in various types of training, when available: 1999		
Use of computers/basic computer training	83	1.02
Software applications	81	1.16
Use of the Internet	75	1.25
Integration of technology into the curriculum/classroom instruction	73	1.39
Follow-up and/or advanced training	65	1.79
Use of other advanced telecommunications	53	2.04
Figure 5.7: Percent of public school teachers reporting number of hours spent in professional development activities in the use of computers or the Internet during the last 3 years: 1999		
0 hours	10	0.78
1-8 hours	43	1.28
9-32 hours	34	1.24
More than 32 hours	12	0.86
Figure 5.8: Percent of public school teachers reporting the availability of certain incentives from the school district for participation in professional development: 1999		
Course credit towards certification is offered	56	1.68
Additional resources for you or your classroom	46	1.56
Expenses are paid	40	1.50
School provides release time	39	1.52
Stipends are provided	32	1.59
Connection to the Internet from home through your school's network	22	1.34
Figure 5.9: Percent of public school teachers reporting availability of certain incentives from the school district for participation in professional development, by school enrollment: 1999		
Less than 300: release time	53	3.94
Less than 300: expenses paid	53	4.12
Less than 300: connection to the Internet from home	13	3.09
300-999: release time	37	1.87
300-999: expenses paid	40	1.88
300-999: connection to the Internet from home	22	1.74
1000 or more: release time	37	3.32
1000 or more: expenses paid	36	3.07
1000 or more: connection to the Internet from home	24	2.61

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Table A-5.5.—Standard errors for the figures and for data not shown in tables in chapter 5: FRSS 1999—Continued

Item	Estimate	Standard error
Chapter 5, section on teachers' feelings of preparedness		
Percent of public school teachers in 1999 who reported feeling very well prepared to use computers and the Internet for classroom instruction	10	0.79
Percent of public school teachers in 1999 who reported feeling well prepared to use computers and the Internet for classroom instruction	23	1.09
Percent of public school teachers in 1999 who reported feeling somewhat prepared to use computers and the Internet for classroom instruction	53	1.30
Percent of public school teachers in 1999 who reported feeling not at all prepared to use computers and the Internet for classroom instruction	13	0.87

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Table A-6.1a.—Standard errors of the percent of public school teachers reporting various barriers as great barriers to the use of computers and the Internet for instruction, by school characteristics: 1999

School characteristics	Great barriers		
	Not enough computers	Outdated, incompatible, or unreliable computers	Internet access not easily accessible
All public school teachers	**1.41**	**1.30**	**1.38**
Instructional level			
Elementary	1.90	1.75	1.85
Secondary	1.94	1.82	1.73
Enrollment size			
Less than 300	3.65	3.42	3.70
300 to 999	1.74	1.64	1.73
1,000 or more	3.04	2.72	2.65
Locale			
City	2.73	2.66	2.62
Urban fringe	2.43	2.14	2.21
Town	3.49	2.98	3.44
Rural	2.75	2.63	2.93
Percent minority enrollment in school			
Less than 6 percent	2.51	2.18	2.45
6 to 20 percent	2.77	2.64	2.47
21 to 49 percent	3.10	2.76	2.78
50 percent or more	2.92	2.77	3.04

NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the analyses presented in this table.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Table A-6.2a.—Standard errors of the percent of public school teachers reporting using computers or the Internet for various activities at school to a large extent, by extent to which they perceived various conditions to be barriers to computer and Internet use: 1999

Teachers' reports of barriers	Activities			
	Practice drills	Solve problems/ analyze data	Word processing/ spreadsheets	Internet research
All public school teachers	**0.97**	**0.76**	**1.11**	**0.85**
Not enough computers				
Not at all	2.28	1.89	2.44	1.84
Small barrier	2.15	1.58	2.69	2.11
Moderate barrier	1.78	1.47	2.41	1.96
Great barrier	1.31	1.14	1.52	1.21
Lack of time in schedule				
Not at all	2.47	2.45	2.60	1.82
Small barrier	2.17	1.61	2.51	2.16
Moderate barrier	1.72	0.97	1.96	1.43
Great barrier	1.40	1.24	1.73	1.31

NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the analyses presented in this table.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Table A-6.3.—Standard errors for the figures and for data not shown in tables in chapter 6: FRSS 1999

Item	Estimate	Standard error
Figure 6.1: Percent of public school teachers reporting small, moderate, or great barriers to their use of computers and the Internet for instruction: 1999		
Lack of release time for teachers to learn/practice/plan ways to use computers or the Internet: barrier to any extent	82	1.03
Lack of release time for teachers to learn/practice/plan ways to use computers or the Internet: small barrier	23	1.07
Lack of release time for teachers to learn/practice/plan ways to use computers or the Internet: moderate barrier	23	1.12
Lack of release time for teachers to learn/practice/plan ways to use computers or the Internet: great barrier	37	1.33
Lack of time in schedule for students to use computers in class: barrier to any extent	80	1.08
Lack of time in schedule for students to use computers in class: small barrier	21	1.05
Lack of time in schedule for students to use computers in class: moderate barrier	27	1.21
Lack of time in schedule for students to use computers in class: great barrier	32	1.29
Not enough computers: barrier to any extent	78	1.17
Not enough computers: small barrier	18	0.98
Not enough computers: moderate barrier	21	1.10
Not enough computers: great barrier	38	1.41
Lack of good instructional software: barrier to any extent	71	1.33
Lack of good instructional software: small barrier	29	1.24
Lack of good instructional software: moderate barrier	22	1.05
Lack of good instructional software: great barrier	20	1.12
Lack of support regarding ways to integrate telecommunications into the curriculum: barrier to any extent	68	1.34
Lack of support regarding ways to integrate telecommunications into the curriculum: small barrier	27	1.16
Lack of support regarding ways to integrate telecommunications into the curriculum: moderate barrier	23	1.11
Lack of support regarding ways to integrate telecommunications into the curriculum: great barrier	18	1.04
Inadequate training opportunities: barrier to any extent	67	1.38
Inadequate training opportunities: small barrier	27	1.18
Inadequate training opportunities: moderate barrier	21	1.10
Inadequate training opportunities: great barrier	18	1.03
Outdated, incompatible, or unreliable computers: barrier to any extent	66	1.41
Outdated, incompatible, or unreliable computers: small barrier	20	1.04
Outdated, incompatible, or unreliable computers: moderate barrier	20	1.10
Outdated, incompatible, or unreliable computers: great barrier	25	1.30
Lack of technical support or advice: barrier to any extent	64	1.35
Lack of technical support or advice: small barrier	26	1.14
Lack of technical support or advice: moderate barrier	22	1.07
Lack of technical support or advice: great barrier	16	1.00
Concern about student access to inappropriate materials: barrier to any extent	59	1.39
Concern about student access to inappropriate materials: small barrier	28	1.17
Concern about student access to inappropriate materials: moderate barrier	18	1.02
Concern about student access to inappropriate materials: great barrier	13	0.89
Internet access is not easily accessible: barrier to any extent	58	1.50
Internet access is not easily accessible: small barrier	16	0.93
Internet access is not easily accessible: moderate barrier	16	0.99
Internet access is not easily accessible: great barrier	27	1.36
Lack of administrative support: barrier to any extent	43	1.46
Lack of administrative support: small barrier	20	1.07
Lack of administrative support: moderate barrier	14	0.92
Lack of administrative support: great barrier	9	0.79
Figure 6.2: Percent of public school teachers reporting lack of release time to learn, practice, or plan ways to use technology as a small, moderate, or great barrier to the use of computers and the Internet for instruction, by years of teaching experience: 1999		
3 or fewer years: small barrier	28	3.09
3 or fewer years: moderate barrier	22	2.77

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Table A-6.3.—Standard errors for the figures and for data not shown in tables in chapter 6: FRSS 1999—Continued

Item	Estimate	Standard error
3 or fewer years: great barrier	25	3.22
4 to 9 years: small barrier	26	2.47
4 to 9 years: moderate barrier	21	2.28
4 to 9 years: great barrier	34	2.80
10-19 years: small barrier	22	2.12
10-19 years: moderate barrier	22	2.07
10-19 years: great barrier	41	2.54
20 or more years: small barrier	21	1.73
20 or more years: moderate barrier	25	1.92
20 or more years: great barrier	39	2.04
Figure 6.3: Percent of public school teachers reporting lack of support regarding ways to integrate technology into the curriculum as a small, moderate, or great barrier to the use of computers and the Internet for instruction, by percent minority enrollment in school: 1999		
Small barrier: Less than 6 percent	26	2.20
Small barrier: 6 to 20 percent	29	2.48
Small barrier: 21 to 49 percent	27	2.35
Small barrier: 50 percent or more	26	2.27
Moderate barrier: Less than 6 percent	24	2.11
Moderate barrier: 6 to 20 percent	24	2.34
Moderate barrier: 21 to 49 percent	24	2.07
Moderate barrier: 50 percent or more	21	2.40
Great barrier: Less than 6 percent	19	1.92
Great barrier: 6 to 20 percent	15	2.22
Great barrier: 21 to 49 percent	13	1.70
Great barrier: 50 percent or more	24	2.40
Figure 6.4: Percent of public school teachers reporting lack of institutional and technical support as small, moderate, or great barriers to the use of computers and the Internet for instruction, by availability of a technology coordinator: 1999		
Lack of administrative support: technology coordinator available: barrier to any extent	41	1.54
Lack of administrative support: technology coordinator available: small barrier	20	1.11
Lack of administrative support: technology coordinator available: moderate barrier	13	0.98
Lack of administrative support: technology coordinator available: great barrier	8	0.79
Lack of administrative support: no technology coordinator available: barrier to any extent	55	3.70
Lack of administrative support: no technology coordinator available: small barrier	22	3.04
Lack of administrative support: no technology coordinator available: moderate barrier	16	2.61
Lack of administrative support: no technology coordinator available: great barrier	17	2.74
Lack of support regarding ways to integrate technology into the curriculum: technology coordinator available: barrier to any extent	66	1.46
Lack of support regarding ways to integrate technology into the curriculum: technology coordinator available: small barrier	28	1.24
Lack of support regarding ways to integrate technology into the curriculum: technology coordinator available: moderate barrier	23	1.19
Lack of support regarding ways to integrate technology into the curriculum: technology coordinator available: great barrier	15	1.03
Lack of support regarding ways to integrate technology into the curriculum: no technology coordinator available: barrier to any extent	79	2.95
Lack of support regarding ways to integrate technology into the curriculum: no technology coordinator available: small barrier	22	3.04
Lack of support regarding ways to integrate technology into the curriculum: no technology coordinator available: moderate barrier	24	2.95
Lack of support regarding ways to integrate technology into the curriculum: no technology coordinator available: great barrier	33	3.36
Lack of technical support or advice: technology coordinator available: barrier to any extent	60	1.47
Lack of technical support or advice: technology coordinator available: small barrier	27	1.24
Lack of technical support or advice: technology coordinator available: moderate barrier	20	1.12
Lack of technical support or advice: technology coordinator available: great barrier	12	0.95
Lack of technical support or advice: no technology coordinator available: barrier to any extent	87	2.58

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Table A-6.3.—Standard errors for the figures and for data not shown in tables in chapter 6: FRSS 1999—Continued

Item	Estimate	Standard error
Lack of technical support or advice: no technology coordinator available: small barrier	17	2.71
Lack of technical support or advice: no technology coordinator available: moderate barrier	30	3.23
Lack of technical support or advice: no technology coordinator available: great barrier	39	3.21
Chapter 6, introduction		
Percent of public school teachers in 1999 who reported that they did not use computers or the Internet for instruction	47	1.36
Chapter 6, section on differences in teachers' reports of great barriers in the availability of and access to computers and the Internet		
Percent of elementary public school teachers in 1999 who reported not enough computers was a great barrier	36	1.90
Percent of secondary public school teachers in 1999 who reported not enough computers was a great barrier	43	1.94
Percent of public school teachers in 1999 from schools with less than 300 enrollments who reported not having enough computers was a great barrier	25	3.65
Percent of public school teachers in 1999 from schools with 300 to 999 enrollments who reported not having enough computers was a great barrier	38	1.74
Percent of public school teachers in 1999 from schools with 1000 or more enrollments who reported not having enough computers was a great barrier	46	3.04
Percent of public school teachers in 1999 from city schools who reported not enough computers was a great barrier	43	2.73
Percent of public school teachers in 1999 from rural schools who reported not enough computers was a great barrier	31	2.75
Percent of elementary public school teachers in 1999 who reported outdated, incompatible, or unreliable computers was a great barrier	27	1.75
Percent of secondary public school teachers in 1999 who reported outdated, incompatible, or unreliable computers was a great barrier	21	1.82
Percent of public school teachers in 1999 from schools with less than 6 percent minority enrollments who reported outdated, incompatible, or unreliable computers was a great barrier	22	2.18
Percent of public school teachers in 1999 from schools with more than 50 percent minority enrollments who reported outdated, incompatible, or unreliable computers was a great barrier	32	2.77
Percent of elementary public school teachers in 1999 who reported Internet not easily accessible was a great barrier	28	1.85
Percent of secondary public school teachers in 1999 who reported Internet not easily accessible was a great barrier	23	1.73
Percent of public school teachers in 1999 from schools with less than 6 percent minority enrollments who reported Internet not easily accessible was a great barrier	24	2.45
Percent of public school teachers in 1999 from schools with 6 to 20 percent minority enrollments who reported Internet not easily accessible was a great barrier	20	2.47
Percent of public school teachers in 1999 from schools with more than 50 percent minority enrollments who reported Internet not easily accessible was a great barrier	36	3.04
Chapter 6, section on differences in teachers' reports of lack of time as a great barriers		
Percent of public school teachers in 1999 who reported inadequate training opportunities as a great barrier:		
Instructional level: elementary	18	1.34
Instructional level: secondary	19	1.59
Enrollment size: less than 300	17	3.22
Enrollment size: 300 to 999	17	1.27
Enrollment size: 1,000 or more	20	2.12
Locale: city	19	2.07
Locale: urban fringe	17	1.59
Locale: town	19	2.75
Locale: rural	18	2.24
Percent minority enrollment in school: less than 6 percent	20	1.98

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Table A-6.3.—Standard errors for the figures and for data not shown in tables in chapter 6: FRSS 1999—Continued

Item	Estimate	Standard error
Percent minority enrollment in school: 6 to 20 percent	17	2.04
Percent minority enrollment in school: 21 to 49 percent	16	1.85
Percent minority enrollment in school: 50 percent or more	20	2.36
Percent of students in school eligible for free or reduced-price lunch: less than 11 percent	15	2.42
Percent of students in school eligible for free or reduced-price lunch: 11 to 30 percent	19	1.98
Percent of students in school eligible for free or reduced-price lunch: 31 to 49 percent	17	2.10
Percent of students in school eligible for free or reduced-price lunch: 50 to 70 percent	18	2.64
Percent of students in school eligible for free or reduced-price lunch: 71 percent or more	19	2.94
Main teaching assignment: self-contained classroom	19	1.65
Main teaching assignment: math/science	18	2.28
Main teaching assignment: social sciences	19	1.99
Teaching experience: 3 or fewer years	18	2.90
Teaching experience: 4 to 9 years	17	2.18
Teaching experience: 10 to 19 years	18	1.91
Teaching experience: 20 or more years	19	1.59
Percent of elementary public school teachers in 1999 who reported lack of time in students' schedule to use computers and the Internet in class was a great barrier	34	1.74
Percent of secondary public school teachers in 1999 who reported lack of time in students' schedule to use computers and the Internet in class was a great barrier	28	1.70
Chapter 6, section on institutional and technical support for using technology		
Percent of public school teachers in 1999 who had a technology coordinator at school	86	1.00
Percent of public school teachers in 1999 who had a technology coordinator at school, by school and teacher characteristics:		
Instructional level: elementary	86	1.35
Instructional level: secondary	87	1.36
Enrollment size: less than 300	83	3.02
Enrollment size: 300 to 999	86	1.27
Enrollment size: 1,000 or more	88	1.84
Locale: city	86	1.85
Locale: urban fringe	86	1.75
Locale: town	88	2.07
Locale: rural	86	2.20
Percent minority enrollment in school: less than 6 percent	85	2.08
Percent minority enrollment in school: 6 to 20 percent	90	1.57
Percent minority enrollment in school: 21 to 49 percent	86	2.04
Percent minority enrollment in school: 50 percent or more	84	2.13
Percent of students in school eligible for free or reduced-price lunch: less than 11 percent	90	2.14
Percent of students in school eligible for free or reduced-price lunch: 11 to 30 percent	87	1.94
Percent of students in school eligible for free or reduced-price lunch: 31 to 49 percent	88	1.93
Percent of students in school eligible for free or reduced-price lunch: 50 to 70 percent	86	2.31
Percent of students in school eligible for free or reduced-price lunch: 71 percent or more	79	3.20
Main teaching assignment: self-contained classroom	83	1.71
Main teaching assignment: math/science	88	1.81
Main teaching assignment: social sciences	88	1.61
Teaching experience: 3 or fewer years	88	2.41
Teaching experience: 4 to 9 years	86	1.97
Teaching experience: 10 to 19 years	86	1.76
Teaching experience: 20 or more years	87	1.54
Percent of public school teachers in 1999 with 10 to 19 years of teaching experience who reported lack of administrative support was a great barrier	13	1.71
Percent of public school teachers in 1999 with 20 or more years of teaching experience who reported lack of administrative support was a great barrier	7	1.11

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

Appendix B

Survey Methodology and Data Reliability

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Survey Methodology and Data Reliability

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Data for this report were drawn primarily from the 1999 "Public School Teachers Use of Computers and the Internet" survey, conducted through the Fast Response Survey System (FRSS) of the National Center for Education Statistics (NCES). Supplemental data presented in this report were taken from the National Assessment of Educational Progress (NAEP) administrations, Current Population Surveys (CPS), and past FRSS surveys on computers and the Internet in public schools. The following sections will describe the data sources and analytical procedures used to calculate the descriptive estimates presented in this report.

The Fast Response Survey System (FRSS)

The Fast Response Survey System (FRSS), conducted through the National Center for Education Statistics (NCES), was established in 1975 to collect and report data on key education issues at the elementary and secondary level quickly and with minimum response burden. The FRSS was designed to meet the data needs of Department of Education analysts, planners, and decision-makers when information could not be collected quickly through traditional NCES surveys. Data collected through FRSS surveys are representative at the national level, drawing from a universe that is appropriate for each study.

In addition to using data collected as part of the 1999 "Public School Teachers Use of Computers and the Internet" survey, this report drew on data published in previous FRSS publications on the technology available in public schools (Bare and Meek, 1998; Carpenter, 1996; Heaviside et al., 1995, 1997). Sampling and data collection procedures, as well as response rates and definitions of analysis variables for each technology survey, are described in detail in those reports.

Sample Selection for the 1999 FRSS Survey

The sample for the FRSS Survey on Public School Teachers' Use of Computers and the Internet consisted of 2,019 full-time teachers in regular public elementary, middle, and high schools in the 50 states and the District of Columbia. To derive the sample of teachers, a sample of 1,000 public schools was first selected from the 1995-96 NCES Common Core of Data (CCD) Public School Universe File. The sampling frame constructed from the 1995-96 CCD file contained 78,697 regular public schools. Special education schools, vocational schools, alternative/other schools, schools in the territories, overseas Department of

Defense schools, schools with a high grade lower than grade 1 or ungraded, and schools that taught only adult education were excluded from the frame. The frame contained 48,714 regular elementary schools, 14,003 regular middle schools, and 15,980 regular high/combined schools. Elementary schools were defined as schools with the lowest grade less than or equal to grade 3 and the highest grade less than or equal to grade 8. Secondary schools were defined as schools with a lowest grade higher than or equal to grade 7 and a highest grade less than or equal to grade 12. Combined schools were defined as having a lowest grade less than or equal to grade 3 and a highest grade greater than or equal to grade 9. Secondary schools and combined schools were combined into one category for sampling. Middle schools were assigned to either the elementary or the secondary/combined stratum depending on their grade span.

The public school sampling frame was stratified by instructional level (elementary and secondary/combined) and school size (less than 300, 300 to 999, and 1,000 or more). Within the primary strata, schools were also sorted by type of locale (central city, urban fringe, town, rural), geographic region, and percent of students in the school eligible for free or reduced-price school lunch to produce additional implicit stratification. A sample of 1,000 schools was then selected from the sorted frame with probabilities proportionate to size, where the measure of size was the square root of the estimated number of full-time-equivalent (FTE) teachers in the school. The sample contained 500 elementary schools and 500 secondary/combined schools. Each sampled school was asked to send a list of their eligible teachers, from which a teacher sampling frame was prepared. The teacher sampling frame was designed to represent regular full-time teachers who taught in any of grades 1 through 12. Only teachers whose primary assignment was bilingual education/English as a second language, special education, and vocational education were excluded. To prepare the teacher lists, schools were asked to start with a list of all the teachers in the school, and then to cross off the following types of teachers: part-time, itinerant, and substitute teachers; teachers' aides; unpaid volunteers; principals (even those who teach); kindergarten or preschool teachers; or anyone on the list who was not a classroom teacher (e.g., librarians, secretaries, or custodians). Next, schools were instructed to cross off the list any teachers whose primary teaching assignment was bilingual education/English as a second language, special education, or vocational education.

Within selected schools, teacher sampling rates were designed to select at least one but no more than four teachers per school, with an average of slightly more than two teachers per school. The resulting sample of 2,019 teachers contained 1,016 elementary school and 1,003 secondary/combined school teachers.

Respondent and Response Rates

A letter and instruction sheet for preparing the list of teachers was sent to the principal of each sampled school in October 1998. The letter introduced the study, requested the principal's cooperation to sample teachers, and asked the principal to prepare a list of teachers that included only full-time teachers. Telephone followup was conducted from November 1998 through March 1999 with principals who did not respond to the initial request for teacher lists. Of the 1,000 schools in the sample, 7 were found to be out of the scope of the survey (no longer in existence), for a total of 993 eligible schools. Teacher lists were provided by 903 schools, or 91 percent of the eligible schools.

Questionnaires were mailed to teachers in March 1999. Telephone followup was conducted from April through June 1999 with teachers who did not respond to the initial questionnaire mailing. Nonresponse followup was suspended in June because a large portion of schools had closed or were closing, and it began again in September 1999. Teachers were sent a reminder flyer at the beginning of their fall 1999 school year informing them that questionnaires would be mailed to them in about 2 weeks. Questionnaires, along with a magnet with the survey name on it to thank teachers for their participation, were remailed to nonrespondents based on when their schools opened in the fall. Data collection was completed in October 1999. Of the 2,019 teachers selected for the sample, 172 were found to be out of the scope of the survey, usually because they were not regular full-time classroom teachers. This left a total of 1,847 eligible teachers in the sample. Completed questionnaires were received from 1,674 teachers, or 91 percent of the eligible teachers. The overall response rate was 83 percent (91 percent for the list collection multiplied by 91 percent for the teacher questionnaire). Weighted item nonresponse rates ranged from 0 percent to 1.1 percent for the items presented in this report. Because item nonresponse was so low, imputation for item nonresponse was not implemented.

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Sampling and Nonsampling Errors

The responses were weighted to produce national estimates (see table B-1). The weights were designed to adjust for the variable probabilities of selection and differential nonresponse. The findings in this report are estimates based on the sample selected and, consequently, are subject to sampling variability.

The survey estimates are also subject to nonsampling errors that can arise because of nonobservation (nonresponse or noncoverage) errors, errors of reporting, and errors made in data collection. These errors can sometimes bias the data. Nonsampling errors may include such problems as misrecording of responses; incorrect editing, coding, and data entry; differences related to the particular time the survey was conducted; or errors in data preparation. While general sampling theory can be used in part to determine how to estimate the sampling variability of a statistic, nonsampling errors are not easy to measure and, for measurement purposes, usually require that an experiment be conducted as part of the data collection procedures or that data external to the study be used.

To minimize the potential for nonsampling errors, the questionnaire was pretested with respondents like those who completed the survey. During the design of the survey and the survey pretest, an effort was made to check for consistency of interpretation of questions and to eliminate ambiguous items. The questionnaire and instructions were extensively reviewed by the National Center for Education Statistics and the Office of the Secretary, U.S. Department of Education. Manual and machine editing of the questionnaire responses were conducted to check the data for accuracy and consistency, and cases with missing or inconsistent items were recontacted by telephone. Data were keyed with 100 percent verification.

Table B-1.—Number and percent of responding full-time public school teachers in the study sample and estimated number and percent of full-time public school teachers the sample represents, by school and teacher characteristics: 1999

School and teacher characteristic	Respondent sample		National estimate	
	Number	Percent	Number	Percent
All public school teachers[1]	1,874	100	1,777,940	100
School instructional level[2]				
Elementary	998	54	1,188,974	69
Secondary	738	46	540,264	31
School enrollment size				
Less than 300	194	12	189,946	11
300 to 999	1,025	61	1,172,015	66
1,000 or more	455	27	415,979	23
Locale				
City	445	27	531,055	30
Urban fringe	617	37	667,395	38
Town	275	16	264,875	15
Rural	337	20	314,615	18
Region				
Northeast	313	19	343,093	19
Southeast	388	23	410,159	23
Central	431	26	434,997	25
West	542	32	589,692	33
Percent minority enrollment in school				
Less than 6 percent	466	28	469,677	27
6 to 20 percent	383	23	405,337	23
21 to 49 percent	412	25	446,130	25
50 percent or more	398	24	446,292	25
Percent of public school students in school eligible for free or reduced-price school lunch				
Less than 11 percent	267	16	266,776	15
11 to 30 percent	552	33	573,955	33
31 to 70 percent	587	35	625,066	35
71 percent or more	258	16	300,830	17
Main teaching assignment[3]				
Self-contained classroom	582	42	786,918	44
Math/science	341	25	315,150	21
Other academic subject	463	33	406,733	27
Teaching experience				
3 or fewer years	226	14	249,483	14
4 to 9 years	351	21	376,411	21
10 to 19 years	431	26	462,213	26
20 or more years	662	40	685,402	39

[1] Teachers were full-time public school teachers who taught in any of grades 1 through 12. Only teachers whose main teaching assignment was bilingual education/English as a second language, special education, or vocational education were excluded.
[2] Data for combined schools are not reported as a separate instructional level, because there are very few in the sample. Data for combined schools are included in the totals and in analyses of other school and teacher characteristics.
[3] Teachers were asked to report the field in which they taught the most classes. A self-contained classroom teacher teaches all or most academic subjects to the same group of students all or most of the day (99 percent are elementary teachers). In the other categories, there was a mixture of teachers across instructional level. Forty-three percent of math/science teachers were elementary teachers. The category "other academic subjects" includes English, foreign language, and social studies; 38 percent are elementary teachers. Teachers in other fields (e.g., arts, physical education/health, and technology) are not included as a separate category. They are included in the totals and in analyses of other school and teacher characteristics.
NOTE: Details may not sum to totals because of rounding or missing data. There were very small amounts of missing data for the following variables: percent minority enrollment in school (0.6 percent), and percent of students in school eligible for free or reduced-price lunch (0.6 percent). Percents are computed within each classification variable, but may not sum to 100 because of rounding.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, Survey on Teachers' Use of Computers and the Internet, 1999.

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Variances and Statistical Procedures

The standard error is a measure of the variability of estimates due to sampling. It indicates the variability of a sample estimate that would be obtained from all possible samples of a given design and size. Standard errors are used as a measure of the precision expected from a particular sample. If all possible samples were surveyed under similar conditions, intervals of 1.96 standard errors below to 1.96 standard errors above a particular statistic would include the true population parameter being estimated in about 95 percent of the samples. This is a 95 percent confidence interval.

For example, the estimated percentage of teachers who feel very well prepared to use computers and the Internet for classroom instruction in class is 10 percent, and the estimated standard error is 0.9 percent. The 95 percent confidence interval for the statistic extends from [10 - (0.9 times 1.96)] to [10 + (0.9 times 1.96)], or from 8.2 to 11.8 percent. Tables of standard errors for each table and figure in the report are provided in Appendix A.

Data from the 1999 FRSS technology survey were analyzed using Stata, a computer program which allows users to calculate nationally representative estimates of proportions and standard errors for those estimates. The proportion estimates were weighted to compensate for unequal probabilities of selection and to adjust for the effects of nonresponse, resulting in estimates that can be projected to the U.S. population of elementary and secondary public school teachers. The standard errors for those estimates were computed through a procedure called Taylor Series approximation. This method is used to take into account the variability introduced into the estimates by using sampling procedures other than random sampling. The resulting variances can then be used in the calculation of the test statistics.

Comparisons that have been made between FRSS 1999 estimates in this report have been tested for statistical significance to ensure that the differences are larger than those that might be expected due to sampling variation. The statistical comparisons were based on the Student's *t*

statistic. Differences between estimates are tested against the probability of a Type I error, or significance level. The significance levels were determined by calculating the Student's *t* values for the differences between each pair of means or proportions and comparing these with published tables of significance levels for two-tailed hypothesis testing. Student's *t* values may be computed to test the difference between estimates with the following formula:

$$t = \frac{(E_1 - E_2)}{(se_1^2 + se_2^2)} \quad (1)$$

where E_1 and E_2 are the estimates to be compared and se_1 and se_2 are their corresponding standard errors. This formula is valid only for independent estimates. When estimates are not independent a covariance term must be added to the formula. If the comparison is between the mean of a subgroup and the mean of the total group, the following formula is used:

$$t = \frac{(E_{tot} - E_{sub})}{(se_{tot}^2 + se_{sub}^2 - 2(p)se_{sub}^2} \quad (2)$$

where p is the proportion of the total group contained in the subgroup. When comparing two percentages from a distribution that adds to 100 percent, the following formula is used:

$$t = \frac{(E_1 - E_2)}{(se_1^2 + se_2^2 - 2(r)se_1se_2} \quad (3)$$

where r is the correlation between the two estimates. There are hazards in reporting statistical tests for each comparison. First, comparisons based on large *t* statistics may appear to merit special attention. This can be misleading, since the magnitude of the *t* statistic is related not only to the observed differences in means or percentages but also to the number of students in the specific

categories used for comparison. Hence, a small difference compared across a large number of students would produce a large *t* statistic.

A second hazard in reporting statistical tests for each comparison occurs when making multiple comparisons among categories of an independent variable. For example, when making paired comparisons across different racial/ethnic groups, the probability of a Type I error for these comparisons taken as a group is larger than the probability for a single comparison. When more than one difference between groups of related characteristics or "families" are tested for statistical significance, one must apply a standard that assures a level of significance for all of those comparisons taken together. Comparisons were made in this report only when $p < .05/k$ for a particular pairwise comparison, where that comparison was one of k tests within a family. This guarantees both that the individual comparison would have $p < .05$ and that for k comparisons within a family of possible comparisons, the significance level for all the comparisons will sum to $p < .05$.[2] Therefore, to guard against errors of inference based on multiple comparisons, Bonferroni-adjusted significance testing was used for each set of comparisons presented in this report, as appropriate.

Definitions of Analysis Variables

School instructional level. Schools were classified according to their grade span in the Common Core of Data (CCD).

- **Elementary school**—lowest grade less than or equal to grade 3 and highest grade less than or equal to grade 8.
- **Secondary** school—lowest grade higher than or equal to grade 7 and highest grade 7 or higher.

School enrollment size. Total number of students enrolled as defined by the Common Core of Data (CCD).

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1 U.S. Department of Education, National Center for Education Statistics, *A Note from the Chief Statistician*, No. 2, 1993.

2 The standard that $p < .05/k$ for each comparison is more stringent than the criterion that the significance level of the comparisons should sum to $p < .05$. For tables showing the *t* statistic required to ensure that $p < .05/k$ for a particular family size and degrees of freedom, see Olive Jean Dunn, "Multiple Comparisons Among Means," *Journal of the American Statistical Association* 56 (1961): 52–64.

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- Less than 300 students
- 300 to 999 students
- 1,000 or more students

Locale. As defined in the Common Core of Data (CCD).

- **City**—central city of a Metropolitan Statistical Area (MSA).
- **Urban fringe**—a place within an MSA of a central city, but not primarily its central city.
- **Town**—a place not within an MSA, but with a population greater than or equal to 2,500 and defined as urban by the U.S. Bureau of the Census.
- **Rural**—a place with a population less than 2,500 and defined as rural by the U.S. Bureau of the Census.

Percent minority enrollment in the school. The percent of students enrolled in the school whose race or ethnicity, based on data in the 1995-96 CCD file, is classified as one of the following: American Indian or Alaskan Native, Asian or Pacific Islander, black, or Hispanic. Data on this variable were missing for 0.4 percent of the teachers. The break points used for analysis were based on empirically developed quartiles from the weighted survey data.

- Less than 6 percent
- 6 to 20 percent
- 21 to 50 percent
- More than 50 percent

Percent of students at the school eligible for free or reduced-price lunch. This was based on information collected from the school during the teacher list collection phase; if it was missing from the list collection, it was obtained from the CCD file, if possible. Data on this variable were missing for 0.2 percent of the teachers. This item served as the measurement of the concentration of poverty at the school. The break points used for analysis were based on the breaks used for the 1999 FRSS Internet Access in U.S. Public Schools Survey.

- Less than 11 percent

- 11 to 30 percent
- 31 to 49 percent
- 50 to 70 percent
- 71 percent or more

Teaching experience. Total years of teaching experience, based on responses to question 14 on the survey questionnaire.

- 3 or fewer years
- 4 to 9 years
- 10 to 19 years
- 20 or more years

It is important to note that many of the school and teacher characteristics used for independent analyses may also be related to each other. For example, enrollment size and instructional level of schools are related, with secondary schools typically being larger than elementary schools. Similarly, poverty concentration and minority enrollment are related, with schools with a high minority enrollment also more likely to have a high concentration of poverty. Other relationships between analysis variables may exist. Because of the relatively small sample size used in this study, it is difficult to separate the independent effects of these variables. Their existence, however, should be considered in the interpretation of the data presented in this report.

Teacher Access to Computers and the Internet at Home and School

The data reported in this publication represent all regular full-time public school teachers. Less than 1 percent of these teachers reported that they did not have access to computers or the Internet either at home or at school (table B-2). More than half of all teachers reported they had access to both a computer and the Internet at school and at home.

Background Information

The survey was performed under contract with Westat, using the Fast Response Survey System (FRSS). Westat's Project Director was Elizabeth Farris, and the Survey Manager was

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Cassandra Rowand. Shelley Burns was the NCES Project Officer. NCES requested the survey with support from Linda Roberts, Office of the Secretary, U.S. Department of Education.

Table B-2.—Percent of full-time public school teachers reporting their level of access to computers and the Internet at home, by school level access: 1999

School access to a computer and the Internet	Home access to a computer and the Internet			
	Both computer and the Internet	Internet only	Computer only	Neither
Both computer and the Internet	58	*	18	15
Internet only	0	0	0	0
Computer only	5	0	2	2
Neither	*	0	*	*

*Less than 1 percent.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, Survey on Teachers' Use of Computers and the Internet, 1999

Analysis of Data from the National Assessment of Educational Progress (NAEP)

The Nation's Report Card, the National Assessment of Educational Progress (NAEP), is a congressionally mandated project of NCES and the Department of Education. Since 1969, assessments have been conducted periodically in reading, mathematics, science, and other subject areas. In addition to assessing academic performance in these areas, these surveys also collect background information from students, teachers, and school administrators. As part of the collection of background information, respondents are asked questions on special topics, such as the availability and use of computers in their schools.

Data on the availability and use of technology in public schools were drawn from the following administrations to calculate the NAEP estimates presented in this report: 1990 math and reading assessments; 1992 math and reading assessments; 1994 reading assessment; 1996 math and science assessments; and 1998 reading assessment. Information on the sampling and survey methods used is available in the technical report for each administration.[3]

Data from the NAEP surveys were analyzed using SAS (Statistical Analysis System), a computer program similar to Stata, which allows users to calculate nationally representative estimates

[3] See Phillips and Johnson (1991); Gorman (1994); Allen, Kline and Zelenak (1997); Ballator (1997); and Calderone, Horkay, and King (1997).

of proportions and standard errors for those estimates. SAS computes standard errors through a procedure called jackknife replication. This method, like Stata's Taylor Series procedure, is used to take into account the variability introduced into the estimates by using sampling procedures other than random sampling. The resulting variances can then be used in testing differences among the proportion estimates. All comparisons made between the NAEP estimates presented in this report were tested with Bonferroni-adjusted *t*-tests of the difference between mean proportions.

Analysis of Data from the Current Population Survey (CPS)

The Current Population Survey (CPS) is a monthly survey conducted by the Bureau of the Census to collect data on employment and other characteristics of the civilian noninstitutionalized population. Since the mid-1960s, NCES has funded a supplemental survey each year, to collect information on education-related topics, including computer use and access.

Data collected from teachers and adults in other occupations[4] on the availability and use of technology in their homes were drawn from the following surveys to calculate the CPS estimates presented in this report: November, 1994; October, 1997; and December, 1998. Information on the sampling and survey methods used is available on the CPS Web site.[5] Nationally representative estimates are calculated by summing the products of the variable of interest (e.g., a computer in the household) by the final CPS person weights for all persons having the desired characteristic (e.g., elementary or secondary teachers).

The standard error for an estimated CPS proportion is derived from the following formula:

$$S_{(y)} = \mathrm{SQRT}\left[\left(\frac{1}{y}\right)/(y)\right]p(1-p)\right] \qquad (4)$$

[4] Adults in other occupations includes all survey respondents who reported a profession which was not elementary or secondary teacher.

[5] See http://www.bls.census.gov/cps/cpsmain.htm

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where b is a parameter determined by the Census Bureau and provided on the CPS Web site; x is the estimated number of persons in the base; and p is the estimated proportion.

Estimates of the CPS proportions provided in this report were calculated using Stata. Standard errors were calculated by using the formula listed above. Any comparisons made between CPS estimates were tested with Bonferroni-adjusted t-tests of the difference between mean proportions.

This report was reviewed by the following individuals:

Outside NCES

- David Malouf, Office of Special Education Programs, U.S. Department of Education
- Diane Reed, Office of Educational Technology, U.S. Department of Education
- Linda Roberts, Office of Educational Technology, U.S. Department of Education
- Jeff Rodamer, Planning and Evaluation Services, U.S. Department of Education
- Mary Schifferli, Office for Civil Rights, U.S. Department of Education

Inside NCES

- Ellen Bradburn, Early Childhood, International, and Crosscutting Studies Division
- Shelley Burns, Early Childhood, International, and Crosscutting Studies Division
- Bernie Greene, Early Childhood, International, and Crosscutting Studies Division
- Edith McArthur, Early Childhood, International, and Crosscutting Studies Division
- Marilyn McMillen, Chief Statistician
- Larry Ogle, Assessment Division

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- Valena Plisko, Associate Commissioner, Early Childhood, International, and Crosscutting Studies Division
- John Ralph, Early Childhood, International, and Crosscutting Studies Division
- Carl Schmitt, Elementary/Secondary and Libraries Studies Division

For more information about the Fast Response Survey System (FRSS), contact Shelley Burns, Early Childhood, International, and Crosscutting Studies Division, National Center for Education Statistics, Office of Educational Research and Improvement, U.S. Department of Education, 1990 K Street, NW, Washington, DC 20006-5650, e-mail: Shelley_Burns@ed.gov, telephone (202) 502-7348. For more information about the Survey on Teachers' Use of Computers and the Internet, contact Edith McArthur, Early Childhood, International, and Crosscutting Studies Division, National Center for Education Statistics, Office of Educational Research and Improvement, U.S. Department of Education, 1990 K Street, NW, Washington, DC 20006-5650, e-mail: Edith_McArthur@ed.gov, telephone (202) 502-7393.

Appendix C

Survey Questionnaire

U.S. DEPARTMENT OF EDUCATION
NATIONAL CENTER FOR EDUCATION STATISTICS
WASHINGTON, D.C. 20208-5651

FORM APPROVED
O.M.B. NO.: 1850-0733
EXPIRATION DATE: 07/1999

Public School Teachers Use of Computers and the Internet

FAST RESPONSE SURVEY SYSTEM

This survey is authorized by law (20 U.S.C. 1221e-1). While you are not required to respond, your cooperation is needed to make the results of this survey comprehensive, accurate, and timely.

DEFINITIONS:

E-mail (Electronic mail) – Refers to text messages transmitted across networks and usually accessible only by the addressee.
Distance learning – Refers to the transmission of information from one geographic location to another via various modes of telecommunications technology.
Multimedia – Refers to the use of a computer to produce any combination of text, full color images and graphics, video, animation, and sound.
Self-contained classroom teacher – Teaches all or most academic subjects to the same group of students all or most of the day.

LABEL

IF ABOVE INFORMATION IS INCORRECT, PLEASE MAKE CORRECTIONS DIRECTLY ON LABEL.

Name of person completing form: _____ Telephone: _____

Title/position: _____ Number of years at this school: _____

Best days and times to reach you (in case of questions): _____

E-mail: _____

PLEASE RETURN COMPLETED FORM TO:

WESTAT
ATTN: Rowand, 716610
1550 Research Boulevard
Rockville, Maryland 20850

IF YOU HAVE ANY QUESTIONS, CONTACT:

Cassandra Rowand
800-937-8281, ext. 2247
Fax: 800-254-0984
E:mail: rowandc1@westat.com

According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information is 1850-0733. The time required to complete this information collection is estimated to average 30 minutes per response, including the time to review instructions, search existing data resources, gather the data needed, and complete and review the information collected. If you have any comments concerning the accuracy of the time estimate(s) or suggestions for improving this form, please write to: U.S. Department of Education, Washington, D.C. 20202-4651. If you have comments or concerns regarding the status of your individual submission of this form, write directly to: National Center for Education Statistics, 555 New Jersey Avenue, N.W., Washington, D.C. 20208

FRSS Form No. 70, 3/1999

1a. How many computers (including laptops available on a daily basis) are located in your classroom? _____

1b. How many of these are used for instruction? _____

1c. How many of the computers located in your classroom currently have access to the Internet? _____

1d. How many of the computers not currently connected to the Internet are capable of being connected? _____

2. Do you use computers or the Internet for instruction during class time? Yes..... 1 No 2

3. Do you assign projects that require **your students** to use a computer:

   a. Inside the classroom? Yes..... 1 No 2
   b. Outside the classroom? Yes..... 1 No 2

4. Approximately, what percentage of **your students** have access to a computer **at home**? _____ percent

Because your responses to questions 5 and 6 may be different for different classes/sections you teach, please select a single class/section to use in your responses to questions 5 and 6. The class you select should represent a **typical class** you teach in your main subject area.

5. To what extent do you assign **students in your typical class**, work that involves using computers or the Internet in the following ways? *(If your school does not have these capabilities please circle 5.)*

	Not at all	Small extent	Moderate extent	Large extent	NA
a. Practice drills	1	2	3	4	5
b. Solve problems/analyze data	1	2	3	4	5
c. Use computer applications such as word processing, spreadsheets, etc	1	2	3	4	5
d. Graphical presentation of materials	1	2	3	4	5
e. Demonstrations/simulations	1	2	3	4	5
f. Produce multimedia reports/projects	1	2	3	4	5
g. Research using CD-ROM	1	2	3	4	5
h. Research using the Internet	1	2	3	4	5
i. Correspond with experts, authors, students from other schools, etc., via e-mail or Internet	1	2	3	4	5

6. On average, how frequently do **students in your typical class** use each of the following during class time?

	Not at all	Rarely	Sometimes	Often
a. Computers in the classroom,	1	2	3	4
b. Computers in a computer lab or library/media center	1	2	3	4
c. Internet from the classroom	1	2	3	4
d. Internet from a computer lab or library/media center	1	2	3	4
e. Distance learning via the Internet	1	2	3	4
f. Distance learning via other modes of interactive media	1	2	3	4
g. Graphing calculators	1	2	3	4

Because teachers use computers and the Internet in different ways, questions 7 and 8 refer to the way in which **you** use computers and the Internet.

7. Are the following available to you, and if yes, to what extent do **you** use them?

	Available		If available, extent of use			
	Yes	No	Not at all	Small extent	Moderate extent	Large extent
a. Computers in your classroom	1	2	1	2	3	4
b. Computers elsewhere in the school (e.g., library, computer lab)	1	2	1	2	3	4
c. Computers at home	1	2	1	2	3	4
d. Internet in your classroom	1	2	1	2	3	4
e. Internet elsewhere in the school (e.g., library, computer lab)	1	2	1	2	3	4
f. Internet at home	1	2	1	2	3	4
g. E-mail at school	1	2	1	2	3	4
h. School network through which you can access the Internet from home	1	2	1	2	3	4

i. Telephone in your classroom	1	2	1	2	3	4

8. For each objective listed below, please indicate how much **you** use computers or the Internet at school and at home to accomplish this goal.

	At school			At home		
	Not at all	A little	A lot	Not at all	A little	A lot
a. Create instructional materials (i.e., handouts, tests, etc.)	1	2	3	1	2	3
b. Gather information for planning lessons	1	2	3	1	2	3
c. Access model lesson plans	1	2	3	1	2	3
d. Access research and best practices for teaching	1	2	3	1	2	3
e. Multimedia presentations for the classroom	1	2	3	1	2	3
f. Administrative record keeping (i.e., grades, attendance, etc.)	1	2	3	1	2	3
g. Communicate with colleagues/other professionals	1	2	3	1	2	3
h. Communicate with students' parents	1	2	3	1	2	3
i. Communicate with student(s) outside the classroom/ classroom hours	1	2	3	1	2	3
j. Post homework or other class requirements or project information	1	2	3	1	2	3
k. Other *(specify)* _____	1	2	3	1	2	3

9. In your opinion, how well prepared are **you** to use computers and the Internet for classroom instruction?

Not at all prepared..... 1 Somewhat prepared.... 2 Well prepared..... 3 Very well prepared..... 4

10. To what extent have each of the following prepared **you** to use computers and the Internet?

	Not at all	Small extent	Moderate extent	Large extent
a. College/graduate work	1	2	3	4
b. Professional development activities	1	2	3	4
c. Colleagues	1	2	3	4
d. Students	1	2	3	4
e. Independent learning	1	2	3	4

11. How many hours of formal professional development **in the use of computers and the Internet** did you participate in during the last 3 years?

0 hours	1	9-32 hours	3
1-8 hours	2	More than 32 hours	4

12. Does your school or district:

	Yes	No
a. Require technology training for teachers?	1	2
b. Encourage technology training with incentives?	1	2
c. Leave it up to teachers to initiate participation?	1	2

13. Does your state, district, or school make the following types of training available to you and, if yes, have you ever participated in these programs?

	Available?			Participated?	
	Yes	No	Don't know	Yes	No
a. Use of computers/basic computer training	1	2	3	1	2
b. Software applications	1	2	3	1	2
c. Use of the Internet	1	2	3	1	2
d. Use of other advanced telecommunications (e.g., interactive audio, video, closed-circuit TV)	1	2	3	1	2
e. Integration of technology into the curriculum/classroom instruction	1	2	3	1	2
f. Followup and/or advanced training	1	2	3	1	2

14. Which of the following types of incentives are available to you for participation in training to use computers or the Internet?

	Yes	No	Don't know
a. School provides release time from classes or other responsibilities	1	2	3
b. Expenses are paid (e.g., tuition, travel, books)	1	2	3
c. Stipends are provided	1	2	3
d. Course credit toward certification is offered	1	2	3
e. Connection to the Internet from home through your school's network	1	2	3
f. Additional resources for you or your classroom (e.g. computers, software, etc.)	1	2	3
g. Other (*specify*) _____	1	2	3

15. Is there a "technology coordinator" (i.e., someone on the school or district staff who coordinates teachers' instructional use of computers and helps you or other teachers use computers) at your school?

Yes..... 1 No..... 2

16. Please indicate who at your school provides computer-related assistance to you for each of the following? *(Circle all that apply.)*

	Use of computers	Use of the Internet	Technical support	Integrating technology	Locating software
a. Technology coordinator	1	2	3	4	5
b. Library/media specialist	1	2	3	4	5
c. Classroom teacher	1	2	3	4	5
d. No assistance provided	1	2	3	4	5
e. Other *(specify)* _____	1	2	3	4	5

17. Please indicate to what extent, if any, each of the following are barriers to your use of school computers or the Internet for instruction.

	Not a barrier	Small barrier	Moderate barrier	Great barrier
a. Not enough computers	1	2	3	4
b. Outdated, incompatible, or unreliable computers	1	2	3	4
c. Internet access is not easily accessible	1	2	3	4
d. Lack of good instructional software	1	2	3	4
e. Inadequate training opportunities	1	2	3	4
f. Lack of release time for teachers to learn/practice/ plan ways to use computers or the Internet	1	2	3	4
g. Lack of administrative support	1	2	3	4
h. Lack of support regarding ways to integrate telecommunications into the curriculum	1	2	3	4
i. Lack of technical support or advice	1	2	3	4
j. Lack of time in schedule for students to use computers in class	1	2	3	4
k. Concern about student access to inappropriate materials	1	2	3	4
l. Lack of funding	1	2	3	4
m. Other *(specify)* _____	1	2	3	4

18. Does your school or district have a policy or procedures in place that limit student access to inappropriate material on the Internet? Yes..... 1 No..... 2

19. Including this school year, how many years have you been employed as a teacher? _____ Years
(Include years spent teaching both full and part time and in public and private schools.)

20. What grade(s) do you currently teach at this school? *(Circle all that apply.)*

PK K 1 2 3 4 5 6 7 8 9 10 11 12 Ungraded

21. What is your main teaching assignment (the field in which you teach the most classes)? *(Circle one.)*

a. **Self-contained** (see definition on cover)	1	f. Foreign language	6
b. English/language arts	2	g. Arts (e.g., visual arts, music, drama, etc.)	7
c. Mathematics	3	h. Technology/computer science	8
d. Science	4	i. PE/Health	9
e. Social studies/social science	5	j. Other (*specify*) _____	10

Thank you.